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Proceedings

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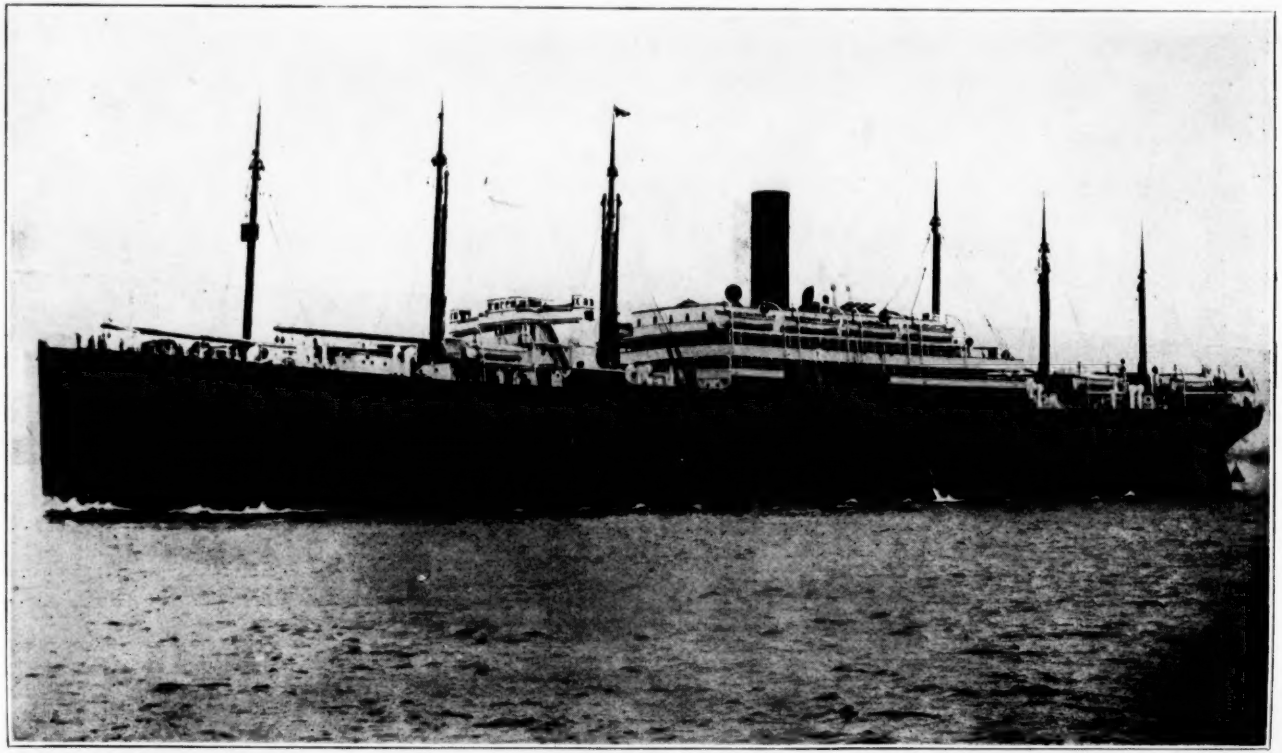

U. S. S. "President Lincoln," Formerly of the Hamburg-American Line

Ex-German Ship Converted into United States Troopship. Carried 5,000 Troops, 7,000 Tons of Cargo and 700 Officers and Men. As She Appeared Before the War. Two Torpedoes Struck Her Abreast the Second Mast and a Third Torpedo Struck Between the Fourth and Fifth Masts.

UNITED STATES NAVAL INSTITUTE PROCEEDINGS

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NARRATIVE OF THE "PRESIDENT LINCOLN"

BY THE COMMANDING OFFICER, COMMANDER P. W. FOOTE, U. S. N.

When the U. S. S. *President Lincoln* was sunk by the German submarine *U-90*, on May 31, 1918, there was an exhibition of cool courage and efficient performance of duty in the face of impending death that will fill a bright page in the records of the deeds of the men of our navy. The crew of the ship was composed largely of young men who, a few months before, had been engaged in the various pursuits of civil life, but the work and experiences during the preceding winter months, when the ship had voyaged back and forth across the ocean, had been a good school and under the guiding hand of the few officers and men of sea experience, this crew met the test in a way that was truly remarkable and the memory of their clock-like performance of duty will always fill with pride the heart of the commanding officer. Colonel Clopton, the commanding officer of the troops on board, afterwards said that the scenes attending the sinking of the ship "seemed like a moving picture" and it was difficult to believe that the ship was really sinking.

We had made five trips to France, having transported about twenty-five thousand soldiers to help "lick the Hun" and we had almost come to believe that the ship bore a charmed life and that

she would not be sunk—such is the way that the human mind adjusts itself to conditions imposed upon it.

We had sailed with many ships in convoy groups, running at night without lights with ships a few hundred yards on each side of us, and we had almost come to regard the danger of collision with other ships—and this was an ever-present danger at night—as more perilous than the danger from the enemy's submarine.

On our previous voyage, however, we had sighted what we believed to have been a submarine, but as he was directly ahead of us in the edge of a fog, he was unable to attack and disappeared before we could fire at him.

We left Brest, France, about dark on May 29 in company with three other naval transports, the *Susquehanna,* the *Antigone,* and the *Rijndam,* and we were escorted by American and French destroyers until dark on May 30, when these boats left us to join a large convoy of ships bound for France. We hoped to pass safely through the remaining part of the war zone under the cover of darkness of that night.

On the afternoon of the thirtieth we had held Memorial Day services in honor of devoted Americans, dead on land and sea, and, in our safety, our hearts went out to those boys in the trenches and on the seas who still faced sudden danger and who might be, at that very hour, giving their lives for Liberty.

As the destroyers, one by one, disappeared in the darkness, we took up the duties of an added vigil, for we had on board many wounded heroes going back to "God's country" to regain their strength, and the long night watches must be kept with diligence until we had passed safely through the remainder of the war zone. We trusted to the darkness as an added measure of safety, for, on the morrow, we would be clear of the U-boats' hunting-ground.

The morning of May 31 broke fine and clear, the sun shone brightly and as we were then in about longitude 17 degrees west and about 500 miles from the coast of France, we felt that the worst dangers of another voyage through the war zone were over and that New York and home were only a little way before us. Satisfied that all was well, a few minutes before nine o'clock I

went into the cabin under the bridge, entered my stateroom for a wash, and then walked into the cabin again for breakfast. At that instant there came a terrific crash and a loud explosion and I noticed that most of the furniture in the stateroom and cabin was wrecked and tossed about.

Starting for the companion way, I was met at the door by the messenger from the bridge, Seaman Leslie Lowenstein, who reported, "Sir, the officer of the deck says we are hit."

Once on the bridge, I found the fact too true; we had been hit, not once, but thrice. The port side of our devoted ship was riddled. The *U-90,* a speedy German submarine commanded by Captain Remy, had haunted our wake since midnight for a chance to strike. With the dawn that chance had come, and, with hell-born aim, he sent us to our doom.

As I reached the bridge, I found that the officer of the deck, Lieutenant Martin, U. S. N. R. F., had sounded the alarm and the call to "battle stations" and had stopped the engines. The gun crews had been on watch at the guns and were ready to fire, but there was nothing to shoot at. The submarine had only exposed his periscope long enough to get his aim, fire, and dive. The track of the torpedoes indicated that he was near the ship on our left, the *Ryndam,* about 800 yards distant, when he fired. Afterwards we found this to have been the case, and the *Ryndam* had tried to ram the submarine, but he was so close to the ship that she could not turn onto him before he dived out of sight.

The four ships were in line abreast and the sub had picked the *President Lincoln* as she was much larger than the others.

All the officers and men and the army passengers went to their stations and the reports of readiness came to the bridge, quite in the usual way as had been done at drill.

The engineer officer reported the engines and boilers "secured" and ready for orders. There was no undue hurrying or confusion. The carpenter's repair parties went below decks and inspected the conditions of the bulkheads and the holds adjacent to the ones flooded with water. This was a dangerous duty, as if the bulkheads should suddenly give away the ship might sink so quickly that these men could not have escaped to the upper decks, but there was no flinching of these men and I was kept informed of the condition of the holds and interior spaces.

From my position on the bridge, I could see the boat crews standing by their boats all along both sides of the ship and other groups of men were standing by the life rafts. At the guns on the forecastle and on the main deck aft, the gun crews were searching for something to fire at.

The hatch just abaft the bridge was open, as men had been engaged in handling coal in that hold when the torpedoes struck the ship and some of these men only barely escaped the inrushing water. The executive officer, Lieutenant Commander Lind, U. S. N., and I watched water rise in this hatch and the engineer officer reported water entering the engine room. The men on watch in the engine and fire rooms under the direction of Lieutenent Baker, U. S. N. R. F., performed their duties with characteristic coolness and efficiency and escaped to the upper decks without the loss of a man.

It soon appeared that the ship was doomed and orders were given to lower the boats and rafts into the water and a little later all hands were ordered to "abandon ship."

The method which we had adopted required every one except the sick to go into the water and swim to the rafts and then to be picked up by the boats. This was done in order that the boats might be lowered practically empty, with only two men in each boat to handle the falls, so as to prevent spilling men from the boats as they were lowered, which, I had observed, generally occurred on occasions when ships have met with disaster. This plan worked splendidly and it largely accounts for the comparatively small loss of life.

The discipline was perfect. With everyone at his station, I ordered the boats lowered, but as the boats were lowering the ship straightened up on nearly an even keel and I thought that it might not be necessary to leave her. I ordered "stop lowering," but the escaping steam prevented the men from hearing the order. They could see me, however, and on a motion of my hand the boats stopped and were held on their falls. A little later, when it was evident that the ship was doomed, I gave the signal with my hands to lower the boats, and they were promptly lowered, but without undue haste.

As the men stood at their stations, I thought of the famous scenes of the sinking of the British ship *Camperdown,* which sank with all hands at quarters and the band playing *God Save the Queen.*

Standing orders required the gun crews to remain at their guns until special orders were given for them to "abandon ship" as there might be a chance to fire on the enemy should he come up to take a look at the damage he had done and to gloat over his prey. He did not appear, but the guns were ordered to open fire in the direction in which he might be as it might prevent another immediate attack. When the guns began firing it was a thrilling and heartening thing to hear the cheers of the men in the water and on the rafts and boats around the ship. They felt that something was being done to "strike back" at the Hun who had, from his hidden position under the water, wounded us to death.

The ship settled gradually, nearly on an even keel, listed a little to starboard and down a little by the stern. It was hard to realize that she was actually sinking before our eyes and we could do nothing to save her.

The chief master-at-arms, Sam Rogers, a sailor man of the old school, devoted to the navy, the ship, her officers and crew, reported to me that the decks were clear of the people. The main deck then being under water, the gun crews were ordered to jump overboard and those of us left went down the ladders into the water and swam to the rafts about a hundred feet from the ship. A few minutes later the ocean seemed to engulf the ship. I noticed the bridge houses and structures crash down under the weight of the waves and then there was nothing except a little wreckage on the surface of the water. Our good ship had gone to her grave, two thousand fathoms under the sea.

The flag was flying on the aftermast when she sank and her guns had been firing up to the last minute, which were fitting honors for the ship which we loved so well, for we had all come to love the "Old *President Lincoln*" and the hardships of the winter had bound men and ship into a team which loved to undertake difficult things.

It had been about thirty minutes from the time she was struck till the ship sank. The job then was to collect all rafts and boats

together and wait—hoping that the destroyers might come to our rescue—in answer to the "S O S" sent by the other ships which were with us. I knew the destroyers were about two hundred and fifty miles away with the other convoy, but I also knew that it was possible that the safety of that convoy might demand the presence of the destroyers, and in that case we should have to wait till they could come from Brest, five hundred miles away. This would mean more than a day and in that time the weather and sea might become so rough as to wash all those on the rafts into the sea. I felt confident of assistance from Admiral Wilson, however, if he had received the radio message, and this confidence proved to be fully warranted, for when Admiral Wilson received the radio reporting the sinking of the ship, he promptly detached one destroyer, the *Warrington,* and an hour later sent another, the *Smith,* from the cargo ships convoy to our rescue. In speaking of this afterwards, Admiral Wilson said he fully realized the military necessity for protecting the supplies in those ships which were vital to fill the needs of the army but the thoughts of the crew of the *President Lincoln* adrift on the ocean five hundred miles from land appealed to him above everything else and he promptly sent the destroyers to our assistance. The American navy, thank God, has not yet reached the point where a bale of hay or a side of beef is worth more than a sailor's life.

But the work of collecting the boats and rafts was soon interrupted and about half an hour after the ship sank we saw what appeared to be a small sailboat approaching, but we knew this could not be and that it was the enemy's submarine returning to look us over and probably take some prisoners. It was really hard to realize that we were at last to look the enemy in the face, but it was a bitter thing to know that we could no longer contend with him and were practically at his mercy.

The sub very soon came among the boats and rafts searching for officers, particularly the comanding officer. He took one man, G. A. Anderson, aboard, but later returned him to his boat. The U-boat commander asked Anderson many questions about the ship, but treated him kindly.

Most of the officers removed their coats and caps so as not to show the marks of their rank. The sub commander asked fre-

quently for the commanding officer, but the men always replied that he had gone down with the ship. At one time the sub was within thirty yards of the boat I was in and the men seemed to enjoy very much telling him that "the captain went down with the ship." By that time he had identified one officer, Lieutenant E. V. M. Isaacs, U. S. N., and had taken him on board. When Isaacs was called from his boat, he said to his men, "Good-bye, men, it is all in the game." This cheerful spirit of Isaacs was characteristic of the entire ship's company, but the later experiences of Isaacs, were to put this spirit to a severe test when he exerted himself to the utmost to escape from the German prisons and finally succeeded after the most thrilling and daring exploits.

The sub remained near us about two hours and went away and returned for a short while, hoping probably that some of the ships which had been with us might return and that he would get a shot at them. This delayed our work and the boats and rafts became widely separated. Although this contingency had been foreseen and many rafts had been lashed together, yet they had drifted apart in groups and it was a hard job to tow them with the boats, which were heavily loaded with men, and this, with the choppy sea, made the rowing hard and we had great difficulty in assembling the boats and rafts.

The danger of a boat or raft being separated from the group was the cause of great anxiety, as in this case it might drift so far during the night that it could not be found. Everyone did his best, however, and when darkness fell we had all the rafts with people in them, securely tied together and the string of twelve boats was tied to the rafts, so we could then all drift together. We could do nothing more than wait and hope that the destroyers would find us before our scant supply of bread and water became exhausted. Lighted lanterns were suspended from oars hoisted in the boats and "coston flares" were burned every few minutes, but as we were so near the surface of the water, these lights could not be seen more than two or three miles.

There were about four hundred and fifty men in the boats and two hundred and fifty on the rafts. It was intended to change places at daylight so that those on the rafts could come into the

boats, as they would be much exhausted after the night on the rafts.

Men and officers were put on watch in each boat and the others told to go to sleep. There was no moon and it became very dark. It was hard to fully realize, even then, that there floating around me on a few boats and rafts, literally on the bosom of the ocean, was that fine body of officers and men who had served so loyally under my command, and that we were all that was left of what, a few hours before, had been a brave ship doing her utmost in our country's service. But I thanked God that I still had so many of them with me, as an approximate muster showed about twenty-five or thirty missing out of a total of about seven hundred on board.

In the blackness and silence of the night with the "slap" of the waves against the boats as we drifted before the wind, it was a time to try our courage and cheerfulness and the light from our little "flare-up" torches seemed so futile in its effort to penetrate the blanket of darkness which covered the ocean.

But the motto of the *President Lincoln* as printed daily on our little paper, called the *Railsplitter* in affectionate memory of that great American patriot and President whose name was borne by our ship, was "Loyalty, Efficiency, and Cheerfulness," and it will always be my pleasure to testify that every one measured up to this motto in a way that was truly inspiring, and not a word of complaint, sorrow, or regret was uttered by those men as we lay there in the sea and waited for the hours to pass. The discipline and willingness to obey orders was perfect and no officer ever commanded a more devoted body of men.

About eleven o'clock some one in my boat thought that he saw a light, but after looking eagerly for it without success, we were settling down in the bottom of the boat again, when from another direction, but almost over us, there suddenly appeared in that wall of darkness a "blinking" white light. There was no mistaking the light this time and I thought of the Star of Bethlehem. The light flashed a few times, then darkness again—the enemy's submarine may be lying in wait for the rescuing ship. Then a megaphone calls from the darkness, "Who is there?" and I reply, "The crew of the *President Lincoln*," and "Who are you?" "The

SURVIVORS OF THE "PRESIDENT LINCOLN" ON BOARD THE U. S. DESTROYER "WARRINGTON"

U. S. S. *Warrington*" is the reply. And then a cheer that rose from those men, literally from out of the ocean, broke the stillness of the night and in its volume and strength this cheer not only expressed overwhelming joy at the arrival of this ship for our rescue, but to me it expressed a greater joy and feeling of thankfulness that those officers and men had met the crucial test and that they had fully measured up to the spirit and motto of our ship as well as to the tradition of our navy.

Although we had been stabbed to death by an unseen enemy, yet we had at all times prepared for this and were always ready to battle with the enemy under just these circumstances hoping that good fortune might give us a chance for striking an effective blow in return even though the odds were all against us.

The captain of the *Warrington*, Lieutenant Commander George W. Kenyon, U. S. N., then asked, "How many boats have you?" To my great joy I replied, "All of them."

In speaking of this afterwards Kenyon said that he had dreaded to ask this question as he feared that the boats and rafts would be widely separated and adrift on the ocean, making it difficult, if not impossible, to find all of them. Such would have been the case had we not provided against this by lashing the rafts together in groups and even then these groups would have been widely scattered but for the hard work and determination of the men, under the encouragement of the officers, who labored hard at the oars all that day, pulling the boats which were heavily loaded with men, a great many of whom were weakened by seasickness. But these men stuck to the job and I shall never forget their loyalty and willingness under these trying circumstances.

The *Warrington* reported that the destroyer *Smith* was also coming to our rescue and she arrived about an hour afterwards under the command of Lieutenant Commander J. H. Klein, U. S. navy.

The transfer from the boats and rafts to the destroyers was promptly accomplished, the darkness causing some difficulty, but this also served as a protection against another attack from the submarine had he been waiting for this purpose.

We had about four hundred and fifty men on the *Warrington* and two hundred and fifty on the *Smith*. The *Warrington* was

quite crowded, but the hot food and cordial welcome we found on those ships almost caused us to forget our troubles. I particularly remember two soldiers who were totally paralyzed and who had been tenderly cared for by our hospital corpsmen. They were placed in the officers' beds and it was a pleasure to see their smiles of cheerfulness and relief after the dangers they had passed through.

A muster showed that we had lost three officers and twenty-three men. Two of the officers, Lieutenant Commander Whiteside (M. C.), the senior doctor, and Lieutenant Commander Mowat (P. C.), the senior paymaster, were last seen on the after deck of the ship and for some unexplained reason failed to escape from the ship. The other officer, Ensign Johnson (P. C.), the junior paymaster, was on a raft near the ship with another man but the raft was drawn under the water when the ship sank and although the man escaped, Ensign Johnson lost his life. He had joined the ship just before we sailed from New York on our last trip and I learned afterwards that he had made especial efforts to be assigned to sea duty on a ship going through the war zone.

Seven of the men were at work in the forward compartment just above the place of the explosion of the two torpedoes and they were either killed by the explosion or immediately drowned by the inrushing water. The other men were on rafts in the vicinity of the hole made by the third torpedo in the after part of the ship and in some way they were drawn under and did not escape.

The loss of the seven men could not be avoided as their fate was sealed when the torpedo exploded, but it is a cause for deeper sorrow and regret that the three officers and the sixteen men did not escape, as they had a chance to do so. It is sad to remember that at one minute they were there on the decks of the ship cheerful and without fear, although the ship was rapidly sinking, and almost in the twinkling of an eye the scene had changed and they were engulfed by the sea. But when the many chances of death to those in the various parts of the ship are remembered, we are thankful that the loss was not greater.

Too much praise cannot be given to Kenyon of the *Warrington* for his skillful navigation when coming to our rescue. He ran a distance of 250 miles and he so correctly allowed for our drift from the position reported by radio from the other ship that he

practically ran on top of us in our boats, a mere speck on the ocean, in the middle of a black night. And we had drifted fifteen miles from the reported position.

At daylight on June 1 we searched the vicinity for other survivors and, finding none, we began the return trip to Brest. About 1:00 P. M. another suspicious looking "sail" was sighted and the destroyer *Smith* rushed to the spot, but the "sail" was an enemy submarine and she dropped twenty-two depth charges in the hope that she might get the U-boat. There was no further evidence of the sub and we were left to conjecture as to whether this "sail" had been a sub and, if so, whether our shipmate, Lieutenant Isaacs, was on board. We were not to know the answer until five months later when Lieutenant Isaacs escaped from the German prison camp after performing one of the most thrilling individual exploits of the war. Isaacs then established the fact that the *Smith* had attacked the *U-90* and that the sub narrowly escaped destruction. The captain of the submarine had sighted the approaching destroyer and promptly dived to a considerable depth. The men at the hydrophones reported the sound of the destroyer's propellers and then they heard the depth bombs explode, followed by others closer to the sub. One was so close as to violently shake the boat and Isaacs thought the seams of the boat would open. Then the explosions appeared to be further away and the danger was over.

In the early morning of June 2 another destroyer from Brest joined us, bringing supplies of food and fuel oil for the *Warrington*, as her supply was nearing exhaustion.

We arrived at Brest about noon of that day where we received a warm welcome from Admiral Wilson and our friends who had so recently wished us "good luck" for our voyage to America.

Our sister ship, the U. S. S. *President Grant*, was there and she sailed a few days later and we gave her our hearty cheers as she quietly put to sea to take her chances through the war zone and we wondered what fortune was awaiting her beyond the headlands of Brest.

I have spoken of the loyalty and devotion of the officers and men of the ship during the hours when none knew what would befall them; the following incidents as reported to me serve well to illustrate.

Chief Petty Officer Oulette told me that he was on the rafts with a number of men and that Chaplain Whimsett was there also and that the chaplain encouraged the men to bear up bravely under their difficulties and very promptly made prayers to the Almighty asking for safe deliverance. But Oulette also said that he feared the men might become down-hearted and thought he would sing a song to cheer them up. I asked him what they sang, and he said they sang many songs but the one they liked best was "Where Do We Go from Here."

An example of courage and devotion which I shall always remember with affectionate pride was that of my steward, a colored boy named Brown. I was told that Brown was last seen with his company of men on the after deck and that he took great care to help others adjust their life-saving jackets, etc., and that, as these men went over the side of the ship, Brown walked forward on the deck. They called to him to come with them but he said, "No, I am not ready yet, I must go to the bridge to see what I can do for the 'old man'" (on board ship, the captain is frequently called the "old man,") but Brown could not come to me as the water by that time had covered the intervening deck and he had to climb over the side and in some way he was lost, but his last words expressed his devotion to what he considered to be his duty and his unselfish thoughts for others in the time of a great crisis.

The men of the *President Lincoln* truly lived and died in keeping with their motto of "Loyalty, Efficiency, and Cheerfulness."

Our ship had the honor to belong to that great part of the navy organized at the beginning of the war called the Cruiser and Transport Force of the Atlantic fleet and which was under the command of Vice-Admiral Albert Gleaves, U. S. N. This force of ships was charged with the duty of transporting our army to Europe and more than a million of our soldiers were transported by those ships under the command of Admiral Gleaves. It was to this force that all the former German ships converted into naval transports were assigned as well as many other ships and the records made by the Cruiser and Transport Force form one of the brilliant achievements of the war.

On our return to America the loss of the *President Lincoln* was announced by Admiral Gleaves in the following words:

FLAGSHIP OF
CRUISER AND TRANSPORT FORCE
UNITED STATES ATLANTIC FLEET

Mail Address
Station H, New York

From: Commander Cruiser and Transport Force.

To: Cruiser and Transport Force.

Subject: Loss of the U. S. S. *President Lincoln.*

1. It is with profound regret that the force commander announces to the Cruiser and Transport Force the loss, by submarine attack of the U. S. S. *President Lincoln* at 9:53 G. M. T. 31 May, 1918. The ship was struck by three torpedoes and sank in eighteen minutes.

2. The *President Lincoln* was homeward bound in company with the *Antigone, Susquehanna,* and *Rijndam;* at the time she was struck she was the second vessel to the left in line formation; the convoy was zig-zagging and had just completed a 20-degree change of course.

3. The ship was abandoned in excellent order, all passengers, including sick, were saved; three officers and twenty-three men were lost and one officer was captured. The small loss of life was due to the splendid discipline of the ship's company and their fine seamanship under the gallant leadership of Commander Percy W. Foote. The force commander deplores the death of these gallant seamen and extends his sympathy to their families.

4. He congratulates Commander Foote, the officers and crew of the *President Lincoln* on their meritorious behavior and desires to express his appreciation of their conduct in the face of disaster.

ALBERT GLEAVES.

I cannot close this narrative without speaking of the loyalty and devotion of the dear ones at home who with tearful eyes but set lips said "good-bye" to those who were called to meet the enemy and if necessary to offer their lives in defense of their country. Those at home prayed for the safe return of their loved ones but they prayed even more earnestly for the victory of the cause which they held to be more sacred than life itself, and it is with a feeling of great pride that I quote the following letter written by the father and mother of Floyd Hedglin who lost his life in the *President Lincoln:*

B. R. Hedglin, Cashier.

EDDYVILLE STATE BANK
EDDYVILLE, NEBRASKA

June 3, 1918.

Bureau of Navigation, Navy Dept.,
Washington, D. C.

Gentlemen:

Your message in regard to the loss of the life of Floyd Herbert Hedglin received today at 2:50 P. M.

We sincerely thank you for your promptness in advising us.

We had only one boy to give to our country and he was only a little past eighteen years of age.

He went of his own free will and accord and with our blessing.

I regret that I have only the one boy to give.

Any little detail that you can send us will be appreciated.

It was God's will that he should be sacrified on the altar of his country and we will accept His will in the matter.

I know that the boy did what he could.

Respectfully,

Floyd's Father and Mother,
/s/ MR. AND MRS. BERT. R. HEDGLIN.

What finer and more glorious sentiments could be expressed! They are truly in keeping with those of Him who taught us to pray, "Not my will, O Lord, but Thine be done."

This is the spirit of America and those heroic men of the *President Lincoln* died with this spirit in their hearts and a cheer on their lips.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

SOME USES AND MISUSES OF THE MOORING BOARD

By William C. I. Stiles, Commander, U. S. Navy

I think that many an officer, when he first studies the mooring board at the Naval Academy, or rather when he is supposed to study it, is at once impressed with its resemblance to a huge spider web, contrived by the devilish ingenuity of man for the purpose of hopelessly enmeshing the poor fly—which is himself. Frequently his impression of its practical use under service conditions is equally discouraging. He sees the ship stand in to her anchorage amid a hullabaloo of ranges and bearings, which the navigator is conscientiously endeavoring to plot, his head meanwhile obscured in the chart desk like an ostrich hiding in the sand. Perhaps the ship somehow fails to reach the appointed spot, perhaps she passes it by about a hundred yards before the navigator finds out that she has arrived. In either case, if the ship has to shift berth, the tendency is to damn the mooring board as an impracticable "gadget," and to fail to criticize the manner of its use. Thus when it comes to a consideration of the less obvious maneuvering problems, he is prone to dismiss the whole matter with the assertion that, like the Peace of God, it "passeth all understanding."

Nevertheless, the mooring board, if correctly employed, is capable of giving very valuable results; but the joker is this—that it must always be considered as an aid to judgment and not as a substitute for judgment. It takes but little experience to convince a man that ships cannot be maneuvered in exact accordance with mathematical formulas and geometrical constructions. There is always some factor, such as the loss of speed on turning or the effect of the wind on the rudder action, which did not enter into the mathematical equation, but which does

decidedly enter into the practical proposition. •Therefore a man cannot rely implicitly on predicted results, but must keep one eye on the board to see what ought to happen and the other on the scenery to see what actually is happening.

Nothing can replace judgment, the so-called "nautical eye," ability to form an approximately correct estimate of distances, angles, and speeds, to trace an imaginary track in the water ahead of the ship and to give the correct orders at the proper times to make her follow it. One of the values of the mooring board is that it tends to develop this judgment. The officer working the board must predict the movement of the ship and must take into consideration as many factors as he can. If his predictions fail to correspond closely to the actual performance, his attention is immediately directed to the discrepancy, and he is frequently able to discover some factor that he failed to consider, and thus to acquire specific knowledge which will serve him in the future. If, however, he maneuvers entirely by eye and fails to hit it, he is, as like as not, at a loss to know whether it was his eye or his judgment that was at fault. Moreover, if one has made a habit of studying all these factors, he will be in a position, when an emergency confronts him calling for immediate action, to form a mental picture of how the problem would look if he had time to plot it and to give a snap decision as to the approximate solution.

When speaking of mooring board problems, I think not so much of the board itself as of the kind of work involved. Such problems may be worked out on the actual board, or in many cases on a chart, or perhaps on some specially contrived "gadget." An important feature is that, whatever the means employed, the work should be done by an officer who can give his entire attention to it; and the location of the board should be such that the officer working it may have a fairly unobstructed view of what is actually going on. If it can be arranged so that the officer conning the ship can conveniently glance at the board instead of receiving verbal reports of the plotting, so much the better. Personally I think that the "Mooring and Maneuvering Board" sheets are cluttered up with too many lines which obscure and confuse the lines which you really want to see. I have never found a use for the sysem of 1″ squares and think that the radial lines might be better represented by a series of dots at

intervals of one-tenth of an inch, and the circles by dots at every degree. Perhaps the Hydrographic Office will change this some day. In the meantime the plotting may be made to stand out more prominently from the printed lines by using a red and blue pencil. These pencils are, of course, too broad-pointed for fine work, but what you are trying to produce is timely and reasonably accurate work, and it doesn't pay to be too fastidious. One thing I have learned by sad experience is this: always erase your problem immediately and completely when the maneuver is finished. Otherwise when a new signal goes up you hustle for the answer, you hastily connect up one of your points with some point you plotted for the last problem, and you give the captain a course to steer about 30° from the correct one. If you are using the red and blue pencil and get caught this way all you have to do is to shift ends and you will never make this mistake.

I have a gadget I use for maneuvering problems instead of the printed forms, locally known as the "Wegee Board," because it is supposed to predict the future and explain the past. It is a sheet of white celluloid with an 18" circle on it graduated in degrees. At the center is the point of a thumb tack inserted from the bottom side and filed down till it barely projects above the board. This is used with an 18" rolling parallel ruler, the edges of which are graduated to a convenient scale, with a small notch in the center opposite the zero mark. You roll the rulers till the edge takes on the tack, then you slide them lengthwise till the tack falls into the notch. Then you can swing them to any desired bearing on the graduated circle, and if the line you want to draw is not a radial one, you can rock the leading edge of the ruler till it clears the tack and walk right over the tack, to whatever point you want to go. Thus you can plot bearings and distances and run up parallel lines all with the same tool—and you have no lines on your board except those that you put there yourself. Turning circles, retardation data, revolution tables and other items for ready reference may conveniently be inscribed in the corners of the board.

Some navigators use the Universal Drafting Machine for plotting maneuvering problems. I have never tried this but it looks like a good scheme, particularly with the addition of a thumb tack, point up and entered from the back side of the sheet to mark the

center of the plotting, and with a small notch filed opposite the zero arc of the scale on the machine. With these additions radial distances could be plotted with the same facility as with the "Wegee Board."

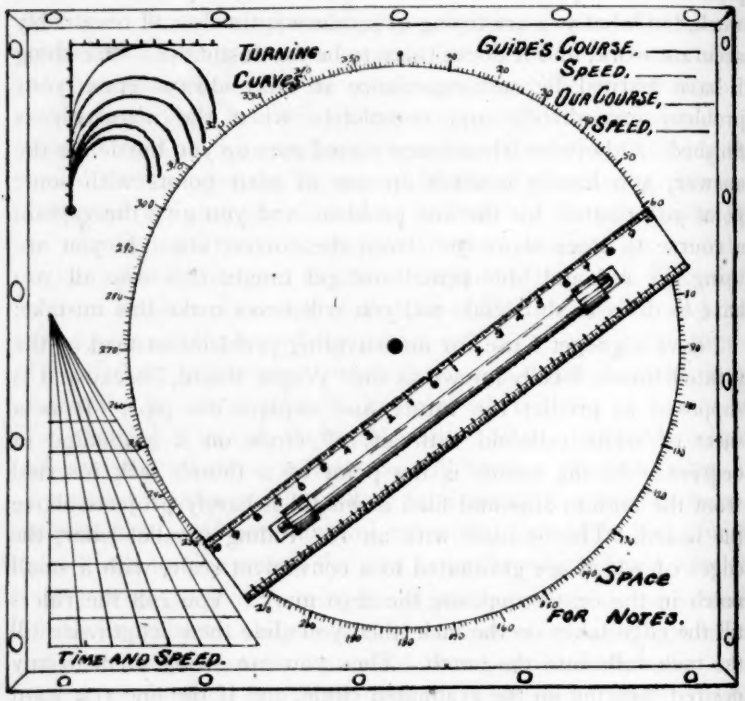

FIGURE 1

Probably the simplest problem from a purely geometrical standpoint is that of anchoring on a prescribed bearing and distance from the flagship, but it has some practical aspects that are not generally touched upon in the treatises on the subject. Say you are standing in towards the Southern Drill Grounds with orders to anchor at "Point X," 1,200 yards south of the flagship. After you have made your number you send her a signal, "Unofficial to OOD. What is the bearing and distance of your anchor?" But if you are wise, you don't wait for an answer. Perhaps it may come in time and then again perhaps not. What you do is

to put your glasses on her and observe her carefully. You can make out nothing but her silhouette, but you observe one of her cranes about midway between her stack and her mainmast. If this is her port crane you are about 30° forward of her beam, but if it is her starboard one, you are the same amount abaft of her beam. Perhaps by noting the direction of the sun and observing whether her illuminated side is turned towards you or not, you can tell which. Perhaps you can tell this by the force and the direction of the wind. If it is force 3 or more, vessels on the Southern Drill Grounds will almost invariably head into it. In localities where there is a strong current this is frequently the governing consideration, and in such case the state of the tide may decide the matter for you. If none of these methods will tell you, you will have to wait until the bearing changes a trifle and note the effect on the crane. If it moves toward the stack and the other crane comes out to meet it, you are coming nearer her beam; if it comes further out from the stack you are coming nearer her bow or stern. As a result of these observations you put a pencil on the gyro repeater and rotate it till you think it is parallel to her heading and that will be it. You select as a scale of 200 yards—1″, so as not to run off the board, and plot her bow 75 yards from the center, which, of course represents her foremast.

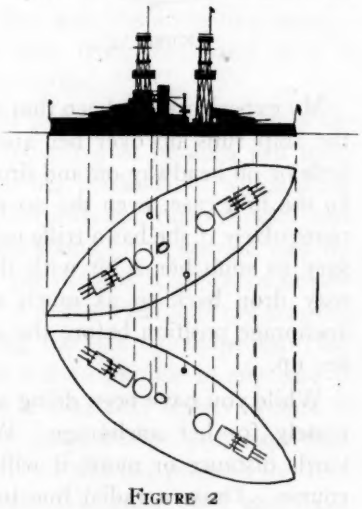

FIGURE 2

Now you have to figure on the distance of her anchor from her bow. Here again you consider the force and direction of the wind, and the state of tide or prevailing current. Also the amount of chain she will probably have out. Unless you have good reasons to the contrary, it will generally be safe to assume that her anchor lies ahead at a distance of about half the scope of her chain for a breeze or force of 3 or 4, and more or less in proportion.

With this assumption you plot her anchor and lay off the position of your anchor 1,200 yards due south from hers. The distance from your bridge to your bow is, say 70 yards, but you must also make an allowance for the space the ship moves between the time you say, "Let her go, sir," to the captain and the time the anchor actually strikes the bottom, rolls over and bites. I allow 30 yards for this and draw a circle with 100 yards radius about the position of the anchor. I will let go the anchor when the bridge reaches this circle, provided we have fairly good headway on at that time.

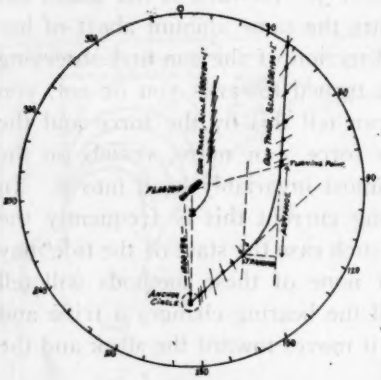

FIGURE 3

My experience has been that it makes a lot of difference whether the ship runs up over her anchor or whether she anchors with little or no headway on and drops back on her anchor with a jolt. In the first case, even the 40 yards allowance is none too much, particularly if she has a trifle too much headway on and it is necessary to snub her a bit with the chain. In the second case she may drop back to as much as 50 yards astern of the actual anchorage position before the anchor takes good hold and brings her up.

While you have been doing all this the ship is heading approximately for her anchorage. When you are still at about 6,000 yards distance or more, it will be convenient to know the exact course. Draw a radial line to the position of your anchor and on this step off a new anchorage point on a scale of, say, 1,000 yards=1 inch. This will permit you to plot your present position on the new scale and to draw a line connecting this with the anchorage point. Steer this line as a course, and if the wind or current make you sag off to leeward you will know it in ample time to correct for it. When your distance gets down to 2,000 yards you can transfer to the large scale plotting and run a new line.

If there is little wind or current you will generally head directly for the anchorage. However, with a strong cross tide or a fresh breeze, or intervening ships, it is frequently necessary to round to before anchoring. In this case it will be best to approach your anchorage on the course that the flagship is heading, so that the wind and current will not set you off the line but will simply retard your progress along it.

You should allow yourself at least 500 yards to steady up for the anchoring point before letting go. Set your course to intersect your anchorage course at this distance from the anchor, plus the 100 yards radius of your anchorage circle, plus a rough allowance for your transfer in turning.

To plot accurately the theoretical position for putting over your rudder, first lay off your transfer, according to your turning data, to the right or left of your present course. Then run back, from the intersection of this line with the anchoring course, a distance equal to your advance and from this point drop a perpendicular line on your present course.

This will give you the theoretical point for putting over your rudder, but don't rely on it too implicitly just because you have plotted it accurately. Each ship has her peculiarities which must be taken into consideration. Mine, for instance, turns rapidly into the wind, as in this case. I would stand by to correct this by easing the rudder in the middle of the turn, if it appeared necessary; or, with a very fresh breeze, I might even slip my turning point 50 or 100 yards further along the line to compensate for this feature. Don't expect to come out on the line in any case—except by good luck. If you miss it, it is an easy matter to draw a new line from the position you do come out on and steer that as a course. It is well not to attempt to plot her position too frequently. Better to get comparatively few good plots and have time to get them down properly on the board, to note the significance and to check up the progress of the ship by eye from the general aspect of things around you, than to concentrate your entire effort in trying to keep up with an over-zealous assistant navigator. Your observers should be trained to conform to your most economical speed. Moreover, they should be particularly cautioned against making too much noise. One man yelping on the bridge in an excited tone of voice can do a lot to disorganize

things by producing the general impression that a frightful emergency is taking place. Everybody has to yell to be heard above the uproar. The steersman gets nervous, the captain becomes fidgety, probably you go up in the air a trifle yourself. You make a horrid botch of the job and when it is all over, wonder why things wouldn't come out right for you.

Another point to remember is to be sure that your stadimeters are in adjustment just before you start taking distances. Somebody may have bounced one on the desk since it was last used. It is most discouraging to find out, after you think you have done a nifty job, that you are about a hundred yards out of position on account of an unlooked-for stadimeter error. .

If you are coming direct for the anchorage point with a cross wind or tide, head up a little from the course plotted on the board and note the effect. It is best to over-correct for your expected leeway a trifle and keep her a little to windward of her line. Then when she loses most of her headway near the anchorage point, she will drift back on her line without changing the course.

Don't get so interested in plotting that you fail to glance occasionally at the flagship and verify her heading. You may have mistaken this at long range, or she may swing while you are coming in. Sometimes she will signal a bearing and distance of her anchor at the last minute which does not check with the position you have assumed for it. In this case quick work is necessary, but all is not yet lost. Plot a new position for her anchor, note then how this compares with the position you have assumed, and slide the position of your anchor over by a corresponding amount. Then head for that point.

It will be convenient to consult your retardation tables and see how many yards the ship will run from the time you stop your engines till the speed has fallen off to 3 knots. Lay this off from your anchorage point back along your track and it will give the position at which the engines should be stopped theoretically. It must, however, be corrected for your estimation of the effect of the wind and current, as well as for the retardation due to putting over the rudder if you have a considerable turn to make. If you have a strong head tide, you can of course approach your anchorage point at greater speed, and this will make the ship more manageable.

The critical point comes when you are 100 or 150 yards from your anchorage circle. At this point sometimes steering becomes difficult due to loss of headway and the wind and the tide tend more and more to make her sag off her line. A comparatively slight sag calls for a greater change of course to correct it. Strong measures are frequently necessary. You must remember that when the bridge reaches the anchorage circle the bow should be pointing approximately for the center of the circle. For instance, in the sketch the ship in position *A* is to leeward of her line but heading well up. If she is making considerable leeway, she may be in position *B* at the instant of letting go, and the anchor will fall on the predicted spot in spite of the fact that the bridge missed the predicted position of letting go by a matter of 25 yards.

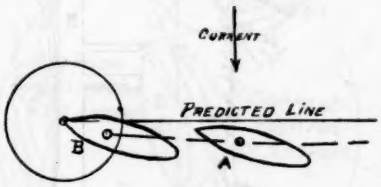

FIGURE 4

Coming now to the proposition of mooring, we will take as an example picking up one of the berths in North River, which we all hope to do frequently. Here we use mooring board methods, but use them on the regular navigational chart.

First lay out the position of your anchors. With 60 fathoms of chain and about 10 fathoms of water, you can allow 55 fathoms, or 110 yards, as the distance from each anchor to the center of the span. The bottom is soft mud, and if you get your anchors a little too far apart you can always drag them together enough to get the swivel on. You want a good taut moor, and, though intentionally starting an anchor from its hold is bad business, there is this litle compensation if you should finally be forced to do it—that by dragging the proper anchor, you can adjust your position a little, if necessary.

Next you lay out the position your bridge will occupy when letting go, downstream from your anchors a distance equal to the length from your anchor stowage to your bridge, plus a correction. I allow 40 yards for this factor on the downstream anchor; but on the upstream one the correction is zero, as we will be dead in the water by that time. Select two good objects ashore to take angles on; close and as near 45 degrees on the bow and on

the quarter as possible from the center of your berth. The reason for these bearings is that in case your gyro is out a bit the result will simply be to put you a trifle ahead or astern of your position, whereas if objects were selected on opposite sides of the river, for instance, an error would throw you off the anchorage line. I always check my gyro by observing ranges on prominent objects in the lower harbor and comparing them with the bearings of these objects from each other on the chart, but I notice that gyros most frequently go bolshevik when you need them most, so it is well to take no unnecessary chances.

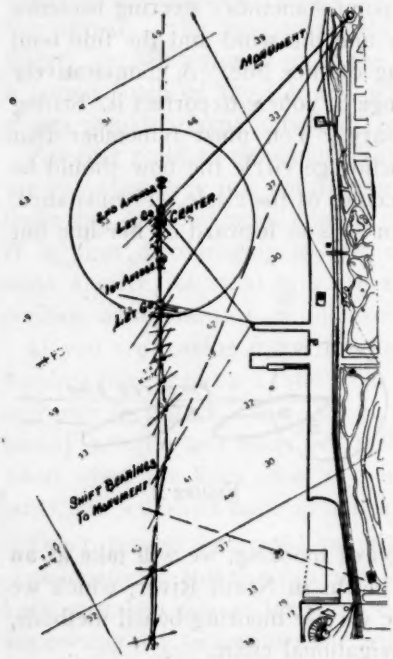

FIGURE 5

Get bearings on these selected objects as soon as the angle between them permits. There may be a sudden jump in the ship's plotted position when you change objects, and it is disconcerting to have this occur at the last minute. Keep her running up the anchorage line with frequent fixes, and when you are almost upon the proper bearing disregard one of the objects and observe rapid bearings on the other.

Let go when this bearing reaches the predicted amount; and when you hear the chain go out take both bearings and the ship's head, and plot the position of your anchor. If it is on the spot all you have to do is to keep her headed up the line and let go when the second predicted point is reached.

On some ships the first lieutenant lets go the second anchor without further orders when the 120 fathoms on the first chain reaches a certain point on the forecastle; but in my opinion this is poor dope. Suppose we have botched the job and let go the first anchor 50 yards to the right of the line on account of the ship's

swinging unexpectedly at the last minute. There is still a good chance to pull it out of the fire. We give hard left rudder and get her canted with the current on the starboard bow. With barely enough way on to breast the tide we will go sideways like a crab for the Jersey shore. Perhaps we may get too much chain out and have to drop back, but if we can get her into position *B* and let go the second anchor 50 yards outside of the line we will have concealed our shame. The next best thing to knowing how to do a good job is to be able to repair a botched one. The ship will then come up at the center of her berth, but the anchors will be on a line about 20° from the direction of the current.

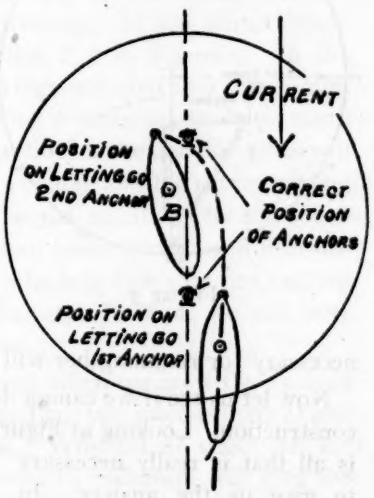

FIGURE 6

We now come to maneuvering problems, a subject which most frequently seems confusing to the uninitiated, but which is perfectly simple if you know what you are driving at.

The simplest case is that of ramming. Suppose we see a submarine bearing north, she submerges on an estimated course of west, at an estimated speed of 8 knots. We have 15 knots' speed available. What course must we steer to pass over her?

All you have to do to solve this problem is to remember the good old seaman's rule, "Risk of collision exists where the bearing does not change." If a vessel draws forward from us she is going to pass ahead, if she draws aft she will pass astern. If she does neither we are going to bump—that is, if nothing is done about it. Breaking out our mooring board, we put the sub at the center and plot our position due south of her. The distance in this case is immaterial. Let us suppose we are at *B* on the sketch. Now at the end of a certain length of time the sub will be at point *C* which is plotted 8 spaces to the westward of her present position. If we have steered the correct course

to intercept her, the bearing will be unchanged; that is, we will be somewhere on the line *C-D* due south from her new position. But we are going 15 knots to her eight. Therefore, while she has moved 8 spaces we will have moved 15. If we draw a circle about *B* with a 15-space radius we must be somewhere on this circle when the sub reaches point *C*. The conclusion is obvious: if we are to accomplish our mission we must steer for point *E* where this circle cuts the line *C-D*. We will have then steamed at 15 knots and the sub will have steamed at 8 and the bearing will be unchanged, so all the conditions necessary for ramming her will be fulfilled.

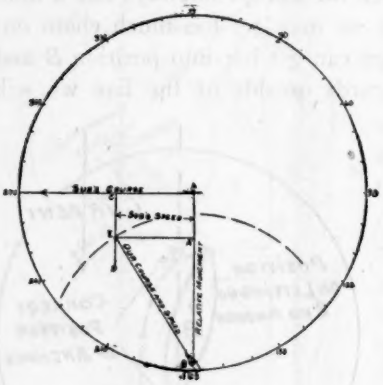

FIGURE 7

Now let us see if we cannot deduce the same result by a simpler construction. Looking at Figure 7, we see that the triangle *BA'E* is all that is really necessary to give us the answer. In this triangle *A'E* represents the sub's course and speed, *BA'* represents the direction of our relative movement, and *BE* gives our own course and speed. We can get the same results more readily by the following construction shown in Figure 8. Plot the submarine's course *A-C* exactly as before. Draw the north and south line through *C*. Draw a circle about *A* with our own speed, 15 knots, cutting the north and south line at *D* and *E*. *AE* will then give the course to ram her—and with this construction we can read it directly on the graduated rim of the mooring board. The triangle *ACE* in

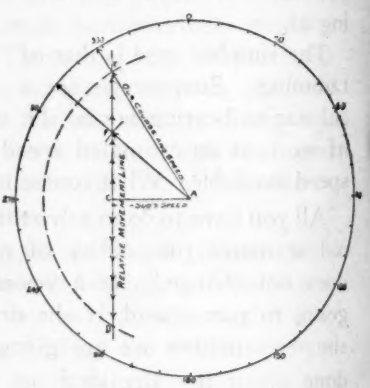

FIGURE 8

Figure 8 is exactly similar to the triangle *A'CE* in Figure 7. In both cases one side represents the course and speed of our ship, another side represents the course and speed of the submarine, and the third represents our movement relative to the submarine.

Get this "relative movement line" firmly fixed in your cranium. It is the foundation of all that is to follow. If the submarine could take bearings and distances on us during our approach the bearings would all be the same, but the distances would constantly be decreasing. If she plotted these fixes they would all fall on the line *BA* in Figure 7. In the same manner if we plotted her bearings and distances they would all fall on a north and south line. Our relative movement is north and south. This "relative movement line" is the line that gives you the dope. Every point on it gives a course and the corresponding speed which could be used with equal accuracy to solve our problem. Thus, if we take at random some point *F* and measure its bearings and distance from *A*, which in this case are bearing 310°, distance 10½, this tells us that at 10½ knots we will have to steer 310° to ram the submarine.

Let us go back a minute to the time when we drew the 15-knot circle about the center in Figure 8 and got two intersections *D* and *E* with the "relative movement line." Why did we select *AE* for our course instead of *AD*? A moment's reflection will give the answer. Both courses will give a relative movement in a north and south line; but *AE* will take us directly towards the submarine to ram it, whereas *AD* would make us diverge from it, but on a constant bearing.

A rule might be laid down covering which one of these points to select, but the best rule of all is "use the bean." If you want to ram, you know at once that you have to head across the other fellow's bow, whereas course *AD* would put her on your quarter.

Now let us complicate the problem a trifle by assuming that the range of the submarine when she disappears is between 5,000 and 6,000 yards and you want to drop depth charges on her. You have already found the course to steer; the proposition is now, how far must you go before rolling overboard the first "ash-can." Plot your present position *B* (Figure 9) 5,000 yards south from the submarine, which is at the center of the board. From here

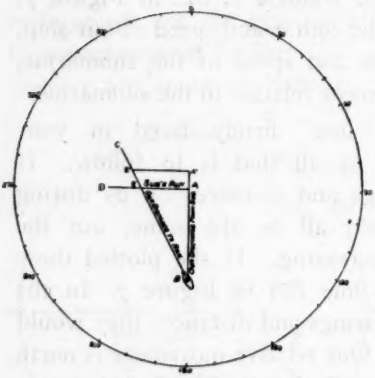

FIGURE 9

run a line *BC* on the course you have previously found and a line *AD* in the direction of the submarine's course. When you reach the intersection of these lines *E*, you will be directly above her, providing the distance was 5,000 yards, and here is where you start bombing her. If you want to know just when you will have covered her, even though the initial range was 6,000 instead of 5,000, plot *A'* 1,000 yards beyond *A*, draw *A'E'* parallel to *AE*, *E'* will then be the point in question.

Now let us go back and see just exactly what we have done. To find the course to steer we formed a triangle (Figure 8) of which the length of one side was the sub's speed, and of another side was our speed. The matter of distances had not entered into the problem at all at this point. All the points were plotted to a scale of speeds. Therefore I call this triangle the "speed triangle." To find where to let go the depth bombs we constructed an exactly similar triangle (Figure 9) except that one side was our *distance* from the sub and the others were the *distance* we had to run and the *distance* the sub is going to make good before she finishes her cruise—we hope. This, therefore, is called the "distance triangle."

By choosing a different scale of speeds the size of one of these triangles would be altered, by choosing a different scale of distances the other would be altered, but in neither case would the solution of the problem be altered. These triangles are mutually related but entirely independent. Bear this in mind, for the most frequent error is to connect up some point that was plotted to a scale of speeds with one that was plotted to a scale of distances. When you do this you are gone.

Let us try another one now. You are in a destroyer acting as submarine screen, stationed 5,000 yards on the starboard bow of the flagship, with her bearing 110° (true). The fleet is steaming

on course 270° at 14 knots. A signal is executed, "fleet change course 45° to the right and resume present formation." You have steam for 18 knots. What course must you steer?

Under the given circumstances you should have all the present positions contantly plotted up—that is, the line *AB* representing the flagship's course and speed and the point *C* representing your assigned station. When the signal goes up, plot the flagship's new course and speed *AB'* and your new position relative to her, *C'*. Your problem is now to move from *C* to *C'*, relative to the flagship. Put your parallel rulers on the line *CC'* and transfer it to point *B'*. This is your "relative movement line," as before explained; and any point on it gives a course and corresponding speed that will take you from *C* to *C'*. The speed you actually intend to use is 18 knots. Therefore strike an arc across this line at *D* with an 18-knot radius from *A*, put your straight edge on *AD* and read your course from the scale on the edge of the board. If you want to save a few seconds make an initial guess by eye and give the order, "Right rudder new course about 350." While he is swinging you draw the two lines necessary for the solution of the problem and before he gets to the course you will be able to announce, "Make that new course 352."

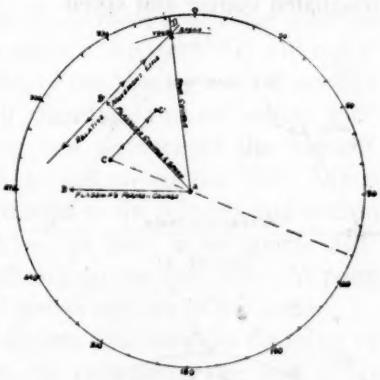

FIGURE 10

Someone may say, "What's the use? On a destroyer you wouldn't know if your actual distance was 5,000 yards or 6,000 yards. You would have to guess the distance, so why not guess the course to steer?"

The answer is this: true enough, your distance may be inaccurate, but it represents the best you can do under the circumstances. If you solve the problem accurately you will end up at the same distance that you started, but if you rely on a guess you will probably increase your error. Should you care to draw a distance triangle, as well as a speed triangle, you can find out how

long it ought to take you to reach the proper new bearing. If this is less than the time it actually took to reach it, you were too far out. By enlarging your distance triangle till it corresponds with the actual results you can find just how far you were out, and can correct your position accordingly. Thus you can get a position based, not on any form of range finding, but on the accuracy with which your ship and the flagship can hold a designated course and speed.

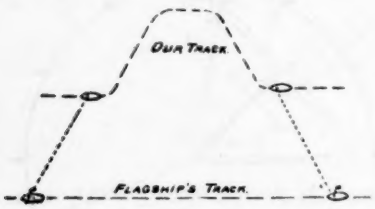

FIGURE 11

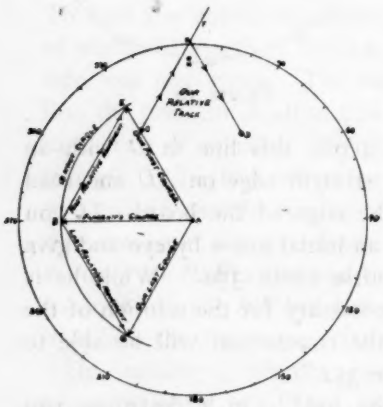

FIGURE 12

Here is one that you may get if they make your ship a division leader.

The fleet is on course west at 15 knots. Your present position is 29° forward of the flagship's beam at a distance of 2,850 yards. A signal requires you to take position 30° abaft her beam at a distance of 2,700 yards. The captain decides to make four 60° turns to drop back thus (see Figure 11) and leaves you to dope out the details.

As before, you have the flagship's course and speed *AB* and your present position *C* already plotted on the chart. The first thing you do is to plot your final position, *D*, 30° abaft the flagship's beam at the prescribed distance. How are you going to get there? Your first change of course will be 60° to the right to 330°, at speed 15. Plot this at *AE*. *BE* will then be the direction of the resulting change of relative position while on this leg. Run this line back with parallel rulers till it passes through *C*. Theoretically the ship should plot up on this line throughout the run out; she will be dropping slowly, as viewed from the flagship and at the same time increasing her distance.

When we make our second turn of 60° we will be steaming parallel to the flagship and at the same speed, and there will be no change of relative position on this leg.

We can therefore go immediately to the consideration of the third leg, during which we will be standing in on course 210° at 15 knots. Plot this course and speed *AG*. The relative change of position resulting from this course will be along the line *BG* and must bring us finally to point *D*. Transfer this line with the parallel ruler to *D;* and point *H* where it intersects *CF* will represent, theoretically, at once the finish of our first leg and the starting point of the last one. We will therefore run on course 330° plotting our positions by bearing and distance of the flagship. These plots should, theoretically, all fall on the line *CH*. When point *H* is reached we turn up parallel to the flagship and remain at point *H* during this run. When we head in on course 210° our plots should, theoretically, all fall on the line *HD*. At point *D* we again turn up on a parallel course and are in position.

We have, however, failed to take into consideration the effect of our various turning circles and the retardation we will suffer from the use of our rudder. These factors will have considerable importance on a maneuver involving as much of the use of the rudder as this one and cannot be overlooked. A study of the ship's turning data will enable the navigator to predict with fair accuracy what their effect should be, but the best results in the long run will be obtained by recording the actual change of relative position due to these turns whenever they are made and working up this data into the form of tables or of a diagram.

Roughly the effect will, of course, be to cause the ship to fall back to her new bearing more rapidly than the diagram indicates so that it will not be necessary to oblique out as far as point *H*. If I had to do it right now without previous results to go by, I would plot *H'* 400 yards inside of *H* and endeavor to turn her up on this point. Then if I come out finally slightly ahead of my position I would know that I had allowed too much and would try 300 yards the next time.

The problems thus far covered are those arising in ordinary fleet work. I will take up just one more problem to show the availability of mooring board methods to solve practically any problem involving maneuvers with reference to a moving ship.

You are an armored cruiser blockading Guantanamo from a position 20 miles, 148° from the entrance, when a lookout vessel reports "enemy destroyer escaping, now passing Windward Point heading to eastward, speed 25 knots."

You have 20 knots' speed. Can you destroy him and, if so, how?

You know that he is heading for Windward Passage, so you set your course for Cape Maysi, to head him off while working out the problem.

Plot your position on the chart at point *A*.

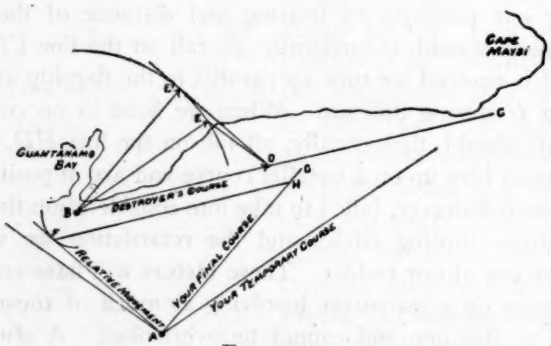

FIGURE 13

Also plot the destroyer's position *B* and probable course *BC*, which from the configuration of the land cannot be less than 78°. Along *BC* plot the enemy's speed, 25 knots at *D*. From *B* draw an arc with a radius equal to your speed, 20 knots. Now, any radius you may draw will represent a possible course and speed for your vessel. Draw *BE*, for instance, in the direction of your temporary course for Cape Maysi. The relative motion produced by the courses *BE* and *BC* will be in the direction *DE*. If you draw a line from *A* parallel to *DE*, this will represent your line of approach as viewed from the destroyer. It is going to pass astern of him. Can anything be done to improve matters? A glance at the figure shows that your course is too far to the right. If you draw *DE'* tangent to your circle from point *D*, and change your course to *BE* , you will swing the line of your relative movement as far to the right as possible. Draw *AF* parallel to

DE', and where this line passes closest to *B* will be the closest you can come to him.

There is one more thing to look out for. Will he be able to round Cape Maysi and escape to the northward before you reach your closest position? Draw *AG* parallel to *BE'* to indicate your actual tracks through the water. Intersect it at *H* with a line through *F* parallel to his course, and you will have your geographical position when you are closest to him. When you reach point *H* you will have him under fire at a range *FB* of 9,000 yards. Thus, though you cannot actually intercept him, you stand a fair chance of sinking him.

As to the availability of geometrical methods in warfare, I would like to close by pointing to the record of that well-known Greek sage, Archimedes. During the siege of Syracuse in about 250 B. C. he terrified his enemies with engines of war adapted from his mathematical studies. Later he destroyed the entire Roman fleet with a burning mirror based on the principle that the angle of incidence is equal to the angle of reflection. His end came when Syracuse was captured by the Romans in 212 B. C. They stormed the walls and came upon the old man drawing figures in the sand. Doubtless he was doping out some new scheme to put them to utter confusion. At any rate he was so wrapped up in his thoughts, he had forgotten there was a war in progress and when they asked him who he was, he merely answered, "Don't disturb my circles."

So they slew him. But right here he discovered one of the most valuable rules in applied geometry, which is this:

Keep one eye on your plotting and the other on what is going on around you.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NAVY YARDS AS INDUSTRIAL ESTABLISHMENTS

By Commander G. A. Bisset, (CC), U. S. Navy

It will appear later on in this article that the above title is in the nature of a screen. The real subject of the article is the maintaining of matériel.

General Order No. 53, which provides for industrial managers at all navy yards, under the commandants, effective July 1, 1921, brings up again the question of organization of navy yards. In this connection, it may be that the following conclusions resulting from fourteen years' navy yard experience under fourteen commandants may interest the readers of the Institute.

Who is so wise as to be able fully to know all things?

Five hundred years ago one of the world's deepest thinkers, Thomas à Kempis, in the above words expressed his virtual agreement with the consensus of modern opinion that "no one man knows it all."

In spite of this belief that goes back to antiquity, there is prevalent, to an astonishing degree, a feeling in the line of the navy that all naval activities should be under the control of the line. While conceding to the line the leading rôle in the navy, it is manifest that the best results cannot be obtained by subordinating the activities of the other corps to the line. The best line officer in the service would make a very poor surgeon, unless he has had training that he does not get as a part of his regular duties. Similarly this A1 line officer would make a poor naval constructor, although his regular duties do make him more or less familiar with the finished product manufactured by the naval constructors. Knowing how to operate the engines, navigate the ship, and handle the guns is an entirely different profession from building the ship—just as fabricating the plates in building

the ship is an entirely different proposition from converting iron ore into the steel plates from which the ship is to be built. Placing a naval hospital under the command of a line officer would be on a par with placing an industrial plant at a navy yard under such command. It would be just as reasonable to make a paymaster gunnery officer of a ship, or a marine officer, supply officer of a navy yard. While each might succeed in the unusual job, success would certainly cause comment—a sure proof that it was unexpected. While General Order No. 53 institutes a very great improvement over previous conditions, it doesn't go quite far enough. It is necessary to face the issue squarely. In mounting a stair one must raise one's foot the height of the step to get ahead. If one raises it only halfway one lands where one started. It is believed to be dodging the issue to make line officer commandants of navy yards heads of the industrial activities of the yards.

Good results should be obtained by a naval constructor manager under a capable line officer commandant who has a proper appreciation of his position and doesn't undertake to do the manager's work for him. If, however, there is a line officer manager the condition is changed. He is just so much "insulation" between the commandant and the yard—just so much insulation, also, against efficiency. While the commandant has as his "cabinet" the captain of the yard to look out for military matters, the supply officer for stores, and the yard surgeon for health—all specialists —he is practically without help in connection with industrial activities, the most important of all, as the manager is no more of a specialist in these matters than the commandant himself. While, therefore, in order to be assured of a successful administration, the commandant should have a manager with vast experience in all the thousand and one problems of an industrial yard—employment of labor, civil service rules, planning systems, drafting rooms, shop organization, yard equipment, plant maintenance, transportation system, care of loose and hand tools, operation of power houses, etc.—he must, in the case under discussion, get along without this expert adviser. A man with a navy yard experience of fifteen years or so is familiar with navy yard "history" and will not make nearly so many mistakes as the less experienced man and will know the answer to many a problem that the other

will have to work out himself with a strong probability that the answer he gets is not the correct one but had been tried before and discarded. A line officer may be rewarded for some specially meritorious work at sea by being made industrial manager at a navy yard. If he understood the requirements of the position and the probability of his losing such reputation as he had acquired he would scarcely think of accepting. Even if seagoing should some day become popular, it is impossible to conceive of a naval constructor's accepting a position as executive officer of a battleship as a reward for his having done good work in connection with its construction. No one would realize better than the naval constructor that the last fifteen years' experience that had made him a capable naval constructor had removed him that much further from fitness for line duties. At that, the chances are in his favor, as he once performed line duties while the line officer manager never performed construction corps duties.

The monthly pay of officers attached to an average navy yard will probably be about $25,000, that is, $300,000 per year. Considered as an industrial plant it is evident that $300,000 is a terrific overhead, bearing in mind the output of an average yard. A private plant of the same capacity would probably have fewer than one-fourth the officials. Navy yard organizations show small return for the outlay, with many high ranking officers performing only nominal duties. At one of the smaller yards recently there were forty-four commissioned officers in the industrial department. When we go down the line in the navy yard organization, until we find the man that really does the work of an industrial manager, we are liable to find that besides all the problems he has to solve that legitimately belong to a manager (and there are plenty) he is burdened with many unnecessary troubles due to the nominal managers ahead of him to whom he must explain every contemplated move and persuade them of its necessity before he can go ahead. The nominal manager may get along all right if recommendations come to him approved by all concerned, but if his advisers disagree he is in a quandary.

It is believed to be literally true that there is no such thing as an efficiently operated government-owned industrial plant. The causes of this condition are fairly numerous but the main causes

are few and readily understood. While, perhaps, most people attribute unsatisfactory results to graft this is totally lacking in the navy, to which this article particularly refers. The worst charge that can be made against individuals is well-meaning incompetence.

In a democracy, where each person has an equal "say" in the government, it is clear that those people that know something about industrial management (or anything else) are vastly outnumbered by those that know nothing about it. The natural inertia of mankind makes this majority slow to make any changes.

It is purely accidental if the majority of the people of a democracy ever do anything well, such as elect the best men to high offices. The majority is always ignorant and uninformed and swayed by anything but reason. The intelligent and progressive always constitute a small minority—the greater the intelligence the smaller the minority.

In a large unwieldy democracy, correcting anything that is wrong is a long tedious process—it takes so long for the small minority that "knows" to instruct the vast majority until sufficient public sentiment is created to force the change. Moreover, of that small minority few have the public spirit or incentive to undertake the huge task of educating the masses. The large democracy is liable therefore to meet the fate of the great pachyderm that sinks further into the mire that is made more fluid through its own frantic efforts to emerge.

A man who has sufficient skill as a politician to become Chief Executive of the democracy could hardly, unless he is a superman, be also the man best qualified to be business manager of the country, nor is he apt to select the best department heads (looking at the matter mathematically).

Assuming that the chance of the best business manager's becoming Chief Executive is one in one thousand (very optimistic) and the chance that he will select the best department heads is one in one hundred, the chance that in November of every fourth year we shall get the best possible department heads is only one in one hundred thousand. In other words, it is practically a mathematical certainty that we shall not.

It would seem, then, that the moves for the betterment of the service must come from the service itself rather than from an

executive. It behooves the service, therefore, to enlighten itself. Hence, everyone with a few meager candle-power should contribute his quota so that eventually the illumination will become general.

The work that is being done at the War College at Newport for the fighting branch of the service is of incalculable value. Surely this institution is not paralleled in any country in the world. Certainly the instruction there received can not otherwise result than in bringing our line officers to the very pinnacle of fighting efficiency. With these officers and suitable matériel, the country may rest secure behind the first line of defense, the navy.

Suitable matériel—there is the rub—matériel efficiently constructed and efficiently maintained. Matériel may win or lose a battle or a war. Defective powder in a shell that lodged near the sternpost of the *Kearsarge*, causing the shell to fail to explode, probably saved the *Kearsarge* from sinking rather than the *Alabama*—the difference between victory and defeat.

Or, to quote from more recent experience, the inferiority of English matériel, in defensive qualities, resulting in three battle cruisers being utterly destroyed by gunfire at the battle of Jutland while no German armored vessel was similarly destroyed, would, in the case of a foe of equal or nearly equal strength, have caused the loss of sea dominion to England.

Does our matériel compare with our personnel? Sadly—no!

Our matériel and our personnel should meet on that "pinnacle of efficiency."

While the construction of our matériel is fairly satisfactory and may compare favorably with that of foreign countries, it should outclass these countries to the same degree that our personnel does. After the construction of our matériel comes the perhaps more important consideration of maintaining it in the most efficient condition through repairs and alterations.

The excuse for this article is the subject of *maintaining* matériel in the most efficient condition. Maintaining matériel—that is the fatal weak spot in our service armor—that is the mortal disease from which we are suffering. There seems no hope of a cure; the doctors disagree, so the patient dies.

Otherwise reasonable people seem unable to see reason when the question of organization or management of navy yards is

under discussion. Probably few seagoing officers give the matter serious thought, imagining perhaps that their ideas will not be asked for by those with power to make changes. My experience is that the run of ideas of seagoing officers relative to navy yards is chaotic, unfixed and unfriendly. They rarely miss an opportunity to make a dig at a navy yard, evidently being convinced that the naval constructors are responsible wholly and entirely for the situation they mention.

Naval constructors are human and therefore prone to err. They make their quota of errors. These errors become rarer and rarer, however, as they gain experience in navy yards, until after many years' experience and their becoming construction officers, their course is practically clear of such impediments.

At this stage in his career the naval constructor is liable to find himself confrere with an engineer officer doing his first, or, in rare instances, his second tour of duty in a navy yard. Seagoing is now such a grind that it is really imperative for an officer's shore duty to be something of a relaxation. On his first tour an officer realizes that a navy-yard job is anything but a relaxation and many seldom seek a second tour. This confrere will therefore be passing through the same error-making stage that the construction officer passed through some ten years previously. This engineer officer goes after two years or so, and another comes and passes through the same phase, etc., etc. As naval constructors may have twenty-five years' service as construction officers at navy yards (not to mention their experience as assistants in the hull division) it may be expected that their nerves will become shattered from such a long infliction of association with "maky learn" engineer officers. Many vexatious disputes are bound to arise, disputes refereed by a possibly "maky learn" commandant who too frequently sides with the engineer officer because "the line is the thing."

Usually the largest shop in the yard is the machine shop, a large percentage of the material used in the yard passing through this shop at some stage. This shop is in the machinery division. The shop superintendent machinery division is usually a young officer doing his first and only navy yard tour. Without any equipment whatever, he is injected into the position of boss of the largest shop in the yard. As the output of the yard as a whole

depends very much upon the machine shop, one doesn't have to be one of the three wise men to know that the output of the yard is bound to suffer. The shop will merely turn out what the civilian supervisors with their limitations are able to turn out. They are practical men who need and are entitled to get from the shop superintendent technical guidance. The chances are, moreover, that the shop superintendent can get no help from his boss, the engineer officer, who in all probability never was shop superintendent himself. They are both in the position of having to make decisions without having the knowledge of how to decide. After two years when the shop superintendent is detached, he has learned enough about the shops, if he is diligent, to be of some little value. He is then replaced by another young officer who goes through the same instruction period. Thus the shop is a school. The officer doubtless benefits from the schooling; the machine shop certainly cannot, as it has been obliged to get along all the time without a real head. While this schooling has some value, obtained in this way its cost to the Government far exceeds its value. Moreover, the schooling would be far more beneficial to the young officer himself if, instead of serving as shop superintendent, he served as assistant shop superintendent under an experienced shop superintendent.

In the latter case he is learning from a teacher, in the former he merely learns what he can pick up by himself. In other words, not only does the officer benefit but the Government does also—an officer is given good training in shop work without expense to the Government instead of poor training at heavy expense.

The hull division has better shop superintendents than the machinery division. With at least equal initial intelligence and more experience they are bound to be better. Moreover, in the case of the hull shop superintendent, the shops may be his one great consuming interest in life. The knowledge he gets in this position will always be of vital use to him.

At one yard, under normal conditions just before we entered the war, patterns made for one ship by the machinery division cost twenty-seven hundred dollars ($2,700.00). Plans of these castings were sent to an outside concern for quotations. They quoted seven hundred dollars ($700.00)—practically only one quarter the cost in the yard. It is seldom possible to get direct

comparisons of cost such as the above. It is believed, however, that in practically every yard work done in the machinery division will cost much more than it should. In other words, much of the appropriation for repairs expended by the machinery division is wasted. In still other words, much more repair work could be done with the same appropriation if the work were done efficiently.

Some years ago the old ordnance department of a navy yard desired to draw from Store No. 1 white pine sixteen inches wide and sixteen feet long—nothing else would do. Such wide lumber being particularly rare and expensive, inquiry was made as to the purpose for which it was desired. It was wanted to make transportable rifle racks which are eight inches wide and four feet long! These racks had been costing ten dollars ($10.00) each. The Portsmouth yard now makes them, thanks to the skill of naval constructors, for about one dollar and sixty cents ($1.60) each.

The naval appropriations have recently been cut to the bone. Thousands of men are being discharged from navy yards. The navy seems to be driving on a "lee shore" without the wherewithal to "claw off." Such small funds as are available for upkeep of the fleet should be let out of the strongbox with grudging care only upon the strongest guarantees that each dollar buys the maximum of repairs—not just twenty-five cents' worth, or fifty cents' worth. Is any naval officer so short-sighted or is his patriotism of such a brand that he prefers half a navy, so long as repairs are controlled by the line, to a full navy kept in repair by the constructors? The case is similar to that refereed by King Solomon where the false mother preferred half a dead baby to surrendering the whole live one to its real mother. It is absurd to imagine that any naval officer prefers a half navy to a full navy. All merely want to be "shown." Would that the Lord repeat His creative act of the third (?) day of the creation when He said, "Let there be light."

Very recently a number of battleships were at a yard for repairs. Workmen and facilities were available to complete the repairs in record time. What happened? The appropriations, rigidly limited by Congress, were so low that after the clerks and draftsmen and other overhead expenses had been paid, very

little was left to pay for labor. Consequently, instead of staying at the yard about two months these vessels had to stay nearly six months, waiting until the monthly allotments totaled enough to pay for the necessary repairs. During all this time there was being wasted, through inefficiency, Government funds that could have been used to advantage to effect earlier completion of these repairs. A little insignificant looking barometer indicates the approach of a ship-wrecking storm. Likewise, at the yard in question, one little item where a comparison was obtainable indicated where to look for leakages of real moment where comparisons were not readily obtainable. This little item was the cost of upkeep of air tools. The hull division for a considerable time had been oiling and making minor repairs to its own air tools, accurate records being maintained to ascertain the cost of the work in detail. Even the unit cost per tool was available, labor and material separately. "Proper authority" directed that the upkeep of hull division air tools be handled by the machinery division. Accurate records showed that after this event the labor cost of upkeep, per tool, reached as high as four times the previous cost, the total excess over the previous rates amounting to $5,000 in six months—practically $1,000 a month—enough to keep several destroyers in repair.

Of the two types of economists one says, "figures never lie," and the other, ironically, "you can prove anything by figures"—directly opposite viewpoints.

The above figures are the kind that do not lie and they prove a lot! Moreover, after expending so much on upkeep, the machinery division did not keep the tools in as satisfactory condition as formerly. Machinists couldn't be expected to know as much about when an air hammer is in satisfactory condition as a riveter or a chipper and calker.

Just as on board ship surgeons are selected from all the officers on board to do surgical work because their experience, education, and training make them most suitable for this work, so at shore stations should managers of the industrial plants be selected from the corps of naval constructors, for identical reasons.

Moreover, to carry the analogy further, just as at naval hospitals a surgeon is selected to do the operating work on account of special fitness for this particular work, so from the

construction corps should be selected for industrial managers only those that are particularly fitted for such positions. Most members of the construction corps are distributed over three main classes of work; navy yard work; shipyard work, as superintending constructors; bureau work. Each member of the corps is best fitted for one of these three positions. In fact, it may not be exaggerating to say that some are totally unsuited for one or two of these jobs. It is manifestly undesirable for a man to be given a job for which he is not suited. The man suffers and the job as well. Selection has a legitimate field when made use of as indicated above. There are some constructors that should never be assigned to navy yards jobs in charge of a large number of men and in contact with numerous others, including officers attached to naval vessels. They are temperamentally unsuited for such jobs. These same men may be incomparable on a shipyard or bureau job.

The corps of constructors is now large enough so that it also should have a "finishing school" like the War College where the special talents of the individuals may be ascertained and developed. They should be required to specialize. Once a man's specialty is determined, he should be given the opportunity to make a thorough study of it under competent instructors. Such a method would be far better than learning by mistakes, as at present. It is not intended to infer that the present method is the deliberate choice of those in authority. They have no alternative on account of the large amount of work to be done by a very limited personnel. To the writer, however, the situation appears now to have clarified to such an extent that the above suggestions are in order.

Eventually, therefore, there should be available in the construction corps, industrial manager specialists of whose qualifications even the most carping can have no real doubts. These specialists, trained in the same school, should have similar ideas as to organizations, systems, methods, etc. When, as at present, the seagoing officers find a different system at each navy yard they visit they may be pardoned for doubting the efficiency of any one of them. It is self-evident that one of the various systems must be better than all the others. The new scheme should provide

the machinery for ascertaining the best "system" and making it universal.

With the Utopian arrangement indicated above, when necessary to fill a vacancy in the industrial manager position at a yard, an industrial manager specialist of known ability would be selected, as distinguished from the present system of filling vacancies approximately by seniority.

Although criticism is always necessary so that defects may be corrected wherever they are found, in order that perfection may be approached, no one should deny to navy yards their mead of glory. What they accomplished during the war in spite of inconceivable handicaps was most praiseworthy.

Perhaps the worst handicap under which they labored was the civil service commission. Let us hope that in our next war the enemy will not find as strong an ally in our civil service as he did in the last war. While this statement will surprise many, numerous co-sufferers will recognize the justice of it. This so-called "service" was, in my experience, of no service whatever. To discuss the civil service fully would require an article in itself. May it suffice here to express the hope that the civil service will be ejected from navy yards bag and baggage—until such time as an economy or efficiency commission has investigated thoroughly the civil service and obtained remedial legislation that will convert the civil service from an obstacle to a service. It is only fair to add, however, that with the laws as they are, even the best administered civil service would still be a nuisance.

In looking over the above paragraph I find I have made a charge without a specification. I cite one. In March, 1917, at the Puget Sound navy yard, it was found necessary to obtain ship draftsmen for the large amount of work in prospect. With numerous new shipyards all over the country it was impossible to obtain real ship draftsmen at the rate of pay provided at navy yards, particularly when in order to obtain a satisfactory rate of pay he must meet civil service requirements that had been prepared for peacetime use. It was necessary, therefore, to pick up the best men obtainable and give them temporary appointments subject to non-competitive examination. One draftsman so obtained in March or April, 1917, submitted his non-competitive papers to the civil service commission. In May,

1918, he received notice from the civil service commission that he had failed to pass his non-competitive examination and must be discharged at once.

In the meantime this draftsman had acquired a year's experience as a ship draftsman and was therefore much better qualified than almost any man we could find at that time for a position in the drafting room. In fact, at that time men were being taken on every few days for drafting work that had nothing like the qualifications of the man in question. While it is difficult to conceive of anything more absurd than the above action, the civil service commission was guilty of many other things almost equally absurd.

Great savings are possible at navy yards. These possibilities are by no means confined to the machinery division. Although in hull divisions gradual improvement is being made in methods and processes, eliminating waste, a vast amount of further eliminations is possible. Any item of expense attacked with the idea of reducing the cost is sure to yield gratifying returns. It is essential that the burden of these attacks be borne by the officers, however, as the foremen and mechanics are too busy with routine matters for them to be of material assistance in this work. As examples of what can be done in this way by study, a few instances are cited, as follows:

The squilgee is an article familiar to all naval officers. In attempting to reduce the cost of manufacture of squilgees, and at the same time make them more suitable for the purpose for which they are used, the following was noted.

The type of squilgee in use at the time the study was started had a groove for the rubber blade with equal thicknesses of wood on each side of the groove. These wooden "legs" were also of equal length. The rubber blade was held in by screws. It was found that the forward edge of the groove was badly worn by contact with the deck when too much pressure was brought to bear upon the squilgee when operating it. For this same reason, that is, too much pressure, most squilgees failed by the splitting of the wood at the back of the groove, that is, the wood of the rear leg. The squilgee was strengthened by making the wood of the squilgee thicker, this increased thickness being taken by the rear leg, reinforcing it against splitting. The forward end was

shortened by about one-quarter inch and chamfered so that it would not come in contact with the deck. Nearly four-fifths of the cost of the completed squilgee was the cost of the rubber blade, the highest grade rubber being used. Cheaper grades of rubber were tested, more "compound" being in the cheaper grades. It was found that a satisfactory blade could be obtained for sixteen cents instead of forty cents as formerly paid. In place of the screws, rivets were used, which, being hammered up, brought the wooden sides of the groove tightly against the rubber blade, giving a much stronger squilgee than obtainable when screws were used, screws not drawing the wooden legs against the rubber at all. The net result of the investigation was that a far better squilgee was obtained at about one-half the previous cost.

A much more sensational accomplishment was done in the manufacture of hammocks, the prime consideration being the manufacture of these hammocks as quickly as possible. Through improvements in the sewing machines, all these improvements being designed by the yard, a female employee was able to work the eyelets in ninety-seven hammocks in an eight-hour day when formerly first-class sailmakers had turned them out by hand at the rate of eight per day.

Referring to the question as to whether or not the existence of navy yards is warranted, it will be well to consider the expenditures for the navy during 1920 as taken from the annual report of the paymaster general.

Total expenditures during 1920	$1,078,000,000.00
Operating expenses of the fleet	203,000,000.00
Repairs to ships and equipage and alterations	39,000,000.00
Maintenance of navy yards	172,000,000.00
(Of this amount only $78,000.00 was for maintenance of navy yards [industrial].)	
Improvements to navy yards	87,000,000.00
Cost of output of industrial yards	303,000,000.00
(Includes new construction.)	
Property investment of naval establishment, total	2,911,000,000.00
Ships	1,292,000,000.00
Stations	534,000,000.00
Stores	1,085,000,000.00

Upon analyzing the above figures it will be observed that the repairs and alterations to vessels constitute only 4½ per cent of the naval expenditures; that the maintenance of industrial yards amounted to 7.2 per cent of the total expenditures; that improvements to industrial yards amounted to 5½ per cent.

It is clear from the above that the claim sometimes advanced that all the money appropriated for the navy goes to pay high wages in navy yards is not justified.

As the value of shore stations is 41 per cent of the value of the ships, why not dispose of all the shore stations and put the money derived from them into ships, increasing the navy by 41 per cent? In order to answer this question it is necessary to demonstrate that navy yards are or are not indispensable. It is customary in a discussion of this kind for each of the participants to start with a theory of his own, effort being directed towards finding facts to prove his particular theory. This case is similar. One is not accustomed to preparing a defense for navy yards, as one has been accustomed to their existence as a regular institution. Upon looking around, however, it is not difficult to prepare a defense for them.

In the first instance, every nation that has a navy that amounts to anything also has navy yards. It would appear, therefore, that if navy yards are to be dispensed with, the onus of proving that they can be dispensed with is on those who desire to make a change.

However, waiving this point, with the fleet repairs scheduled as in the United States, so that the absence of vessels from their regular stations for repairs will be minimized and absolutely according to pre-arranged schedule, it must be apparent to anyone that to have these repairs done in a shipyard would be out of the question. Navy yards being under the same military authority as the ships, their operation is under the absolute control of the secretary. On the other hand, in dealing with private shipyards, all repairs and alterations would have to be covered by written contracts. If the contracts are prepared with the usual governmental care, the repair period would be over before the contract would be signed. Moreover, as repairs proceed, the necessity for additional repairs becomes evident. To cover this additional work, no end of complications arise. It is evident, in the first

place, that in allotting the work it will be necessary to obtain bids from all responsible shipyards available. It is evident, moreover, that on account of the uncertainty of all repair work, the price bid will be ample to cover every contingency. That there is tremendous profit in repair work is evident from the fact that the most prosperous shipyard in the United States confines itself to repair work only. It will take no new construction work whatever. While, from new construction, direct comparisons can be obtained between the cost of the work at navy yards and at shipyards, the cost probably being ordinarily in favor of the shipyards, if there is left out of consideration the military feature of keeping the navy yards in good condition for repair work by having new construction work done there, no such comparison is possible in repair work. Repair work in private plants would undoubtedly cost very much more than in navy yards. Moreover, as private plants could not be expected to keep on hand such a large quantity of stores as the navy does—over one billion dollars' worth—the time required for repairs would be increased by the time necessary to obtain material. To shorten the time of delivery, heavy bonuses would have to be paid. Besides, private firms cannot purchase so economically as the Government and they haven't the machinery for inspection that the Government has, this machinery insuring that the material purchased meets the specified requirements. In war, the Government would have to take its chances, along with private shipping companies, in obtaining the services of the shipyards.

It is clear from the above that navy yards are indispensable, that they cannot be disposed of in order to buy ships with the proceeds.

There are many good reasons why there should be navy yards —there are equally good reasons why they should be operated at maximum efficiency; to save the taxpayer or to give us more navy for the same expenditure. Red tape will always handicap navy yards, very much in the way that parliament used to handicap kings and the law still handicaps crime.

"Red tape" is that system in which a man is prevented from doing a thing in the most direct manner through the necessity for conforming to various rules and regulations of higher authority or to the law. Many of these rules, regulations, or laws are

thoroughly justified, others are out of date. It would be absurd, for instance, to use steel for naval construction that had not been inspected—that is justifiable red tape. It is equally absurd to be governed by an old law that states that in making repairs to vessels, if the estimated cost exceeds $3,000, no work shall be done until after it has been recommended by a board of survey composed of various officials, totaling about ten. At the time the law was enacted, $3,000 was probably 1 per cent of the cost of the largest vessels known. Against this figure today would have to be set over $300,000. While much out-of-date or unnecessary red tape could and should be dispensed with, a red tape check is absolutely necessary in any governmental institution.

The last annual report of the paymaster general is about five inches thick. While it contains much information of undoubted interest, it seems hardly possible that its value can compare with its cost. What would be of greater interest would be figures making possible a comparison of the efficiencies of the different yards. Practically the only figures available for comparison now are percentages of general expense and indirect expense. These figures not only mean nothing but are liable to create a wrong impression in the lay mind. What counts, of course, is the total cost of the work regardless of how this total is divided between labor and indirect expense, material costs being practically unaffected by management.

Included in the industrial costs that should be available for purposes of comparing the different yards are:

Electricity per kilowatt hour; total amount consumed per year; total cost; percentage of the total cost to total of the payroll for the year of the yard employees.

Steam per pound; total produced per year; total cost; percentage of payroll.

Air per 1,000 cubic feet of free air; total produced per year; total cost; percentage of payroll.

Heat per pound of steam; total produced per year; total cost; percentage of payroll.

Hydraulic power.

Total power-house costs per pound of steam produced; quantity and cost of fuel used per pound of steam produced; ratio of total payroll of power-house employees to number of pounds

of steam produced during the year; percentages of total steam produced used: to generate electricity; for heat; to compress air; for blacksmith shop; for other power purposes.

If air is used for steam hammers give cost in suitable unit for comparison with cost of operating steam hammer in yards using steam.

Foundry costs per pound for brass, iron, and steel castings and total weight manufactured during the year.

Costs per pound for galvanizing iron and steel; total costs for year and total weight of zinc consumed and total weight of metal galvanized.

Cost per pound or cubic foot of oxygen manufactured at yard during year; total amount and total cost for year and comparison of total cost with total yard payroll. Same for acetylene gas.

Total cost of oxyacetylene welding; total weight of welding metal consumed; percentage of second to first.

Total cost of riveting for year; total direct labor only, total value of output on piecework basis (same piecework schedule being used for all yards for comparative purposes); total riveting hours for year; ratio total riveting hours to total value on piecework basis; total maintenance cost of tools; average maintenance cost per tool.

The above items give an idea of comparisons that should be obtainable among the different yards. The list should be extended to include transportation, cranes, locomotives, etc., as well as practically every activity where a basis for comparison may be found.

In order that the comparisons may be of value "out of pocket" costs only should be used. It is unreasonable for one yard, say, to be charged with depreciation on a plant ten times as large as it may be using for current work—the nine-tenths unused is a military feature—provision for war.

It is hoped that the candor of this article will give no offense as none is intended. I am merely acting upon my theory that to obtain the right solution of any question in dispute, the proper procedure is to keep nothing in reserve but to state the entire case as it seems to the disputant. Nothing would be gained by minimizing the points at issue, agreeing on these and leaving the major items unmentioned to fight about in the future.

In General Order No. 55 the secretary of the navy has stated the necessity for economy and placed the situation up to the officers of the navy. He has made the first move—it is now our move. Shall we fail the secretary and the navy?

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

MILITARY CHARACTERISTICS AND ORDNANCE DESIGN

By Commander H. F. Leary, U. S. Navy

1. The General Board having prescribed in general terms the military characteristics of a ship, such as type, speed, radius of action, armament, armor protection, etc., for any type of new construction, the various technical bureaus, upon approval, and under the direction of the Secretary of the Navy, proceed with the development of the plans. Preliminary or basic designs of the vessel are prepared by the design section of the Bureau of Construction and Repair, and the various other technical bureaus are requested by that bureau to furnish data regarding features of design under their cognizance for incorporation in these designs. The Bureau of Ordnance is requested to furnish preliminary designs or type general arrangements of ordnance equipment, together with weights and centers of gravity of all ordnance material to be carried by the vessel, and to submit general recommendations regarding armor protection. In order that this information may be available and be furnished without delay, it is necessary that the trend of ordnance design be anticipated to a great extent by the bureau.

2. The preparation of designs for turret, secondary battery, or anti-aircraft mounts, torpedo tubes, etc., are undertakings requiring six months to a year's time. The information required by the Bureau of Construction and Repair is generally furnished within a week or two after the request is made, and the design must be sufficiently worked out in advance to furnish at least reliable preliminary data regarding weights and dimensions. Ordnance design is constantly undergoing a process of evolution and systematic development, due to increase in caliber and power

of guns, to the development of new weapons and instruments of warfare, and to the constant efforts of nations to produce types of vessels possessing offensive and defensive features superior to those developed by others.

3. Generally, work of basic design is done by several experienced men in such a manner as to cover the requisite features with accuracy, with the least detail possible and with the least expenditure of time. The governing idea is the determination of the important features of the vessel, after weighing all the possibilities and their various relationships, both to the design itself and to each other. Once this is accomplished satisfactorily, the necessary sketches made, and the data tabulated, the work of developing more detailed plans may be at once undertaken with efficiency and assurance. Aside from the element of loss of time and money due to unfortunate selection of characteristics proposed, the main advantage to be anticipated from the organization of a basic design section is the facility with which it is possible to investigate the effect of variations in dimensions, power, capacity, etc., without occupying the time of the regular drafting force or being embarrassed by relatively unimportant detail. The value of such a section was first formally recognized in the Bureau of Ordnance during the war, and since then all departmental designs have been handled by it, and the results have been such as to establish this system firmly. The caliber of main battery guns of battleships of the leading nations has increased 50 per cent during the past ten years, and in the same period of time the submarine and the flying machine have been perfected; and, by their advent, warfare has been extended into the air and below the surface of the sea.

4. To be prepared to meet the demands of the General Board and the Bureau of Construction and Repair, and to keep up with the progress of ordnance development referred to, it is necessary that improved types of ordnance design be under constant investigation by the Bureau of Ordnance. The main subjects to be investigated and covered by this bureau in connection with the design of capital ships are the questions of caliber of main battery guns and armor protection, both of which are largely dependent upon the assumptions made as to the probable future battle range.

5. Assume, for instance, that we have reason to expect a large increase in battle range, due to improved methods of fire control and increased accuracy of guns. In such a case a complete study and estimate of the situation is undertaken by the Bureau of Ordnance. Let us suppose, as a result of this estimate, that it is decided to investigate the use of the 18″ gun for future capital ship construction. Orders are issued by the Chief of Bureau of Ordnance to the design section to proceed with the design and preparation of the necessary preliminary drawings for the gun, projectile, turret, and other features making up a complete unit. The first step undertaken is the preparation of a preliminary design of gun. The weight of the projectile is tentatively decided upon in order that the ordnance engineer in charge of gun design may have a starting point from which to work. A careful survey is made of the problem to determine the muzzle velocity required to give the desired penetration at the battle range under consideration. Weight of projectile and muzzle velocity being determined, consideration is next given to the problem of interior ballistics. From records of past gun performances and other information available, a powder is selected that will give the desired velocity to the projectile without exceeding normal chamber pressures and give the greatest number of foot pounds of work from each pound of powder in a gun of 45 to 55 calibers in length. For obvious reasons, it is desirable to use existing powders. When this is not possible, the powder expert at the Naval Proving Ground is consulted and a new powder is tentatively selected, of such web thickness as to give the desired rate of burning.

6. The principal characteristics of the gun having been determined, the next step is to prepare a general arrangement drawing. This drawing shows the powder pressure curve, velocity of projectile curve and the strength curve, together with assigned skrinkages and all necessary dimensions. No effort is made at this stage to prepare detail drawings. These, together with all other manufacturing drawings, are prepared by the Naval Gun Factory from the general arrangement drawings furnished by the bureau, when orders are issued to proceed with manufacture.

7. As soon as a decision is reached regarding the weight of the projectile, this data is turned over to the engineer in charge of projectile design, and this work proceeds simultaneously with the

gun design. Until very recently, little was known regarding the important principles entering into projectile design. Projectiles were designed that were strong enough to stand the heavy pressures in the gun without breaking up and which gave satisfactory results from the standpoint of armor penetration. Little was attempted, however, in the design to produce a projectile which would give the most satisfactory results as regards dispersion. From what has been developed during the past two years, it has been found that by observing certain principles of design that are concerned principally with obtaining the proper relation between rotation, moment of inertia of the projectile about the longitudinal and transverse axis, combined with proper band design, the dispersion may be greatly reduced below that obtained in the past when these features were not carefully considered.

8. The features of gun and projectile design having been determined, it is customary to proceed with the manufacture of a type gun and slide, in order not only to prove the important features of gun and mount design but to initiate experiments at the Proving Ground dealing with powder, armor penetration, and accurate ballistic data. Use is also frequently made of wooden models of turrets, guns, and mounts built full size at the Naval Gun Factory.

9. Upon completion of the preliminary plans of the gun, and without waiting for the completion of the type projectile, gun, and mount, the design section of the bureau is engaged in the preparation of the preliminary plans of the turret. It is the present rule to mount turret guns so that practically the maximum range of the gun can be obtained. For all practicable purposes, this means 40 degrees elevation, and the turret is designed on this basis. The turret design is first blocked out roughly in order to get an approximate idea of the best arrangement of mount, ammunition hoist, handling rooms, etc. It is essential that the dimensions of the turret, including the barbette, be made as small as possible, not only on account of the saving resulting in armor weights, but also on account of the reduction of target exposed to the enemy. The diameter of the barbette is governed by the distance from the center of rotation to the extreme position of the gun in recoil. This distance is therefore kept as small as practicable by moving the center of the trunnions as close as

possible to the turret front plate, by reducing the distance from the center of the trunnions to the breech of the gun to the minimum amount, and by limiting recoil of the gun. By moving the center of trunnions close to the front plate, we are also able to reduce the port opening through the front plate to the minimum size. The distance from the center of the trunnions to the breech of the gun is kept a minimum by increasing the weight of the gun yoke above what is actually needed to withstand the forces of recoil or to act as a counter-balance. It has been found from past experience that the trunnion pressure will not be excessive if the recoil of the gun is limited to about three calibers in length. With the position of the gun in the turret approximately determined, it is possible to fix the diameter of the barbette and the exterior dimensions of the turret armor. After the determination of these dimensions in the manner indicated, the elevating gear, rammer, powder and shell hoist machinery are laid out to go in the space provided. Arrangements are also made for the accommodation of personnel, fire control instruments, and range finders.

10. As the design is being laid down, computations are made to properly balance the various parts about the axis of rotation. All oscillating weights are balanced about the trunnions and, as far as practicable, the revolving weights are balanced about the vertical axis of the turret. After the upper portion of the turret has been sufficiently developed, consideration is given to the question of ammunition supply. The best methods for storing and handling the projectiles and powder charges are agreed upon, and machinery is developed to supply projectiles and powder to the gun at the maximum rate, at least three rounds per minute.

11. In the design of powder hoists, it is considered important that the supply of powder from the magazines to the guns be conducted with the least liability of danger to personnel and safety of the ship from explosions that may occur in various parts of the turret. To accomplish this, flame-proof doors are provided in all handling rooms, and the hoist is designed with interlocks, arranged in such a way that there is no direct communication between the turret chamber and magazines at any time. In order to localize the damage resulting from premature explosions and other causes, it is the practice to provide divisional

bulkheads between individual guns, and to enclose the turret officer and fire control group in a booth at the rear of the turret.

12. With preliminary plans available, the Bureau of Ordnance is prepared to supply the Bureau of Construction and Repair and the General Board, within a few days, with such information as is required to develop the preliminary plans of the vessel. In case information is requested regarding plans of a type of construction which has not been anticipated by the Bureau of Ordnance, the development work proceeds in a manner similar to that described above, but it is not possible in such a case to prepare plans in the same amount of detail. As an illustration of what may be accomplished in an emergency, the recent preliminary plans for the 6″ twin mounts for scout cruisers were prepared, and complete information regarding weights, cost, etc., *furnished within a period of three weeks.* This mount represented an entirely new departure in 6″ mounting, but owing to the close co-operation existing between the Bureaus of Construction and Repair and Ordnance it was possible to furnish complete information regarding the mount, and necessary modifications to the ship plans, so that a decision was reached by the General Board and recommendations made to the Secretary of the Navy regarding manufacture within the short period of time mentioned.

13. The Bureau of Ordnance has a series of standard ordnance allowances of ammunition, spare parts, tools, accessories, etc., and the caliber and type of guns having been once established, the use of these tables permits the Bureau of Ordnance to supply the Bureau of Construction and Repair with a table of estimated weights and centers of gravity for all ordnance material entering into the design. Tables are also furnished the Bureau of Construction and Repair, giving the working circles required for all guns, the trunnion pressures which the ship's structure must withstand for each type of gun, and blast diagrams showing effect of muzzle pressures at various distances. This gives all the data necessary to work up contract plans.

14. The General Board is provided with tables and formulas which give all the data necessary to determine penetration of armor, the data being sufficiently broad to cover any combination of caliber of gun and thickness of armor.

15. While the General Board is discussing the tentative

designs, representatives of the technical bureaus are called before it, and a general discussion of the various characteristics ensues in which armor is considered as well as other characteristics. The General Board then draws up tentative characteristics and sends them to the Bureau of Construction and Repair, where the various sketches necessary to show the general details of the design are worked up.

16. From these general sketches, which may cover a number of variations in design, the various weights of armor are computed by the Bureau of Construction and Repair, and then the drawings and weight data are turned over to the Bureau of Ordnance for detailed study. This study is based on general principles of protection only. If the records of the Proving Ground cover experiments which parallel the conditions laid down in the design, the bureau can determine with reasonable accuracy the protection which the various designs afford. If the ship possesses any unusual features, it is probable that no experimental data will exist covering parallel cases, and in this contingency it will probably be necessary to undertake a certain amount of experimental firing at the Proving Ground.

17. When the Bureau of Ordnance has completed its preliminary analysis of the design, or designs, a report is submitted to the General Board, through the navy department, which points out how closely the proposals meet the requirements, or points out where modifications or changes in the proposed designs may be made with benefit to the protection. Up to this stage the quantity of armor allotted to the ship or, in other words, the percentage of weight which can be devoted to armor protection, has been more or less approximate, and if the research of the Bureau of Ordnance shows any unusual conditions, it may be necessary that the allocation of armor be changed. For instance, it may be that a proposal will be made to change the arrangement or armor in such a way as to lighten the total quantity of armor required, or it may be that the research will show that the protection afforded is entirely inadequate and it may be necessary to request an addition to the allocation of weight for armor.

18. Upon these preliminary researches, the General Board generally bases the final general characteristics of the vessel, and

these final characteristics are again transmitted to the Bureau of Construction and Repair for the preparation of final plans.

19. These final plans are again referred to the technical bureaus, and the armor plans are then gone over with the idea of investigating them to determine with precision, not only the amount of protection afforded, but the details of construction, size of plates, connection between plates and bulkheads, etc. It is generally the custom of the Bureau of Ordnance to lay these plans before the manufacturers of armor, in order that the details of plate size, etc., may be agreed upon.

20. After this work had been concluded, and the General Board has given final approval to the plans, theBureau of Construction and Repair draws up contract plans, which are again referred to the technical bureaus. These contract plans are then transmitted to the armor manufacturers for detailed comment, and final fixing of joints, gauges, size of plates, etc.

21. In general, the cognizance of the Bureau of Construction and Repair and the Bureau of Ordnance in regard to the armor is as follows: the Bureau of Ordnance is, in general, responsible for the quality of armor and its manufacture in conformity with the contract plans.

22. The Bureau of Construction and Repair is, in general, responsible for the means of attaching the plates to the ship, connecting the plates to each other, etc. The two bureaus work together jointly in insuring that the plates are made as large as possible (to eliminate joints), and that they are secured to the ship and to each other with the greatest security possible, consistent with the capabilities of the armor manufacturers. Similarly, the Bureau of Ordnance is responsible for fixing the manufacturing tolerances and dimensions to meet the demands of the ship builders as expressed by the Bureau of Construction and Repair.

23. Prior to the advent of what may be styled modern construction, various arrangements and thicknesses of armor were tried, use being made of the obliquity of impact. Gradually design settled down to vertical belts, with few variations, the *Kahtadin* being the only ship which departed from this principle. From 1887 to 1903, armor was gradually increasing its ascendancy over the projectile. It was during this period that modern naval construction ideas were really developed. During this period the

torpedo had an insignificant range and the ram was frankly considered. Gradually, the power of guns was increased, the range of torpedoes was increased, and ram discarded and the generally accepted battle range was increased. After about 1903, however, the development of the projectile and the further increase in gun power gradually reduced the ascendancy of armor. This evolution has proceeded to the present day, but until about 1917, architecture never varied.

24. During the past few years there have been two distinct developments in naval architecture which affect armor: It is now conceded that torpedo risks may be incurred, and this development in opinion has been coincident with a very important and efficient development of anti-torpedo and anti-mine protection. Whether the change in opinion resulted from the development of under-water protection, or whether it was independent of it, is a question, but it is evident that in the present state of opinion and under-water protection, greater risks of torpedo damage will be taken. If this is correct, we are again forced to the conclusion that a material increase in the relative efficiency of our armor protection is mandatory. The other development in architecture is the inclination of the side armor outboard, which was first (recently) used on the British battle cruiser *Hood,* and later copied on our battle cruisers. These are the first instances of a departure from that system of architecture which had been followed so consistently for about twenty-five or thirty years. It is true that in our battle cruisers the inclination was used to bolster a markedly small plate thickness, and in the *Hood* it was used to cover a reduction in thickness of the belt to 11 inches from 13 inches in the *Queen Elizabeth.* However taken, it is a break in the long train of similar ships.

25. Before armor can be properly distributed, it is necessary to know:

(a) The chances of hitting various parts of the ship.
(b) The kind of projectiles the armor must resist.
(c) The effect of such projectiles on armor in various arrangements.

When considering armor, the thickness and quantity are, of course, limited by weight. Taking this limiting weight, we must properly balance the protection given various parts of the ship

working on the principle of "all or none," that is, vital parts should be fully protected, but very valuable weight should not be lost by the distribution of light armor around unimportant parts of the ship. At a very short range the side armor receives more hits, but at medium and long ranges more hits are recorded in the deck armor than in the side armor. At modern battle ranges only about 25 per cent, or less, of all hits will be received in the side armor and the target is essentially a horizontal one. Side armor must be thicker than deck armor, not because it is more likely to be hit or covers more vital parts—but because at short range when velocity is high it is subjected to more direct impact. Side armor may be hit at normal impact, but deck armor will probably be hit at an angle of more than 45 degrees from the normal. It would be useless to provide very heavy side armor and very thin deck armor, or very heavy deck armor and very thin side armor just below the water-line, where direct hits may be received.

26. In regard to attack by bombs from aircraft, there seems little to be feared in the way of penetration. A bomb simply dropped obtains a disappointingly small velocity even when dropped from so great a height as to make its aim uncertain. Even when dropped from extreme heights, bombs will reach a certain velocity at which the acceleration, due to gravity, is equaled by the retardation due to air resistance. This is called the "terminal velocity," and a study of it shows it to be small. To actually drop a bomb with the hope of its weight carrying it through the protective deck is practically impossible. It would take an altitude of about 10,000 feet to put an armor-piercing bomb through a 3½" deck.

27. The next question is that of armament; here we are, as always, limited by weight and space, and several factors must be considered. Our doctrine should be the maximum number of the lightest and handiest guns which will, at extreme fighting range, successfully penetrate the heaviest armor with which enemy craft will oppose them. The factors governing the decision as to the type of primary armament as regards its caliber are:

(a) Range
(b) Penetration
(c) Explosive effect

(d) Probability of hitting
(e) Rapidity of fire.

The total weight allowance will fix the number of guns and as between different calibers the factors which most influence decisions are (b) and (d), as the differences between the others are small. The Naval Treaty on Limitation of Armaments has fixed the caliber at 16″, and it thus becomes a race between designers as to who can turn out the most powerful gun of the lightest weight, the two variables being muzzle velocity and weight of projectile.

28. The most advantageous composition of battery as regards the caliber for the primary armament having been determined, it remains to decide upon the arrangement of battery in order to obtain the greatest arc of fire, or maximum fire efficiency, from each gun. The American practice *has been standardized,* and it is believed that the four 3-gun turret arrangement of the *Pennsylvania* presents the best solution of the problem.

29. To sum up, the general conditions governing the primary armament of the modern capital ship are as follows:

1. The greatest weight that can be allowed for the armament.
2. The number of guns required.
3. Their disposition within each turret (twin, triple or quadruple).
4. Disposition of turrets (superposed, echelon, etc., as affecting the weight of armor carried).
5. The weight of the projectile and powder charge as affecting the number of rounds of ammunition to be carried per gun.

30. It is evident that for similar types of guns and turrets, the larger the caliber of the gun, the larger the turret, and the greater the ammunition weights, and, although modern design has done something to reduce the ratio, it is still very large.

31. The main battery does not fulfill all the necessary functions required of the complete ship's battery, and it is necessary to place on board ship additional weapons which are in the nature of a protective armament to fulfill special requirements. The primary mission of a battleship has already been cared for by the

installation of the heavy armament which is given priority throughout. Therefore, when we come to this secondary armament we find that the greater part of the allowable weight has been used up and that the best spaces and locations for guns have also been assigned. Consequently, the secondary armament is limited to the smallest calibers, the lightest weights, and the smallest number of units that can be expected to do the required work acceptably. The arrangements for these secondary batteries are influenced all the way through by the priority given the main battery, by the necessity for limiting the size and number of guns, and by the necessity of avoiding blast interferences. Ships are crowded more and more by the demands for a heavier main battery, more armor protection, and more speed and greater steaming radius. It is believed that for future construction the secondary battery will probably be mounted in blast-proof enclosed mounts closely resembling a small turret. This appears to be the best compromise solution that can be obtained. Anti-aircraft guns —at least eight—will be on the upper deck so located as to give the best possible arcs of fire, and will also be used as star-shell battery.

32. In developing the detailed plans, the following points require constant and close co-operation between the Bureau of Ordnance and the Bureau of Construction and Repair:

Ammunition stowage and handling arrangements—safety features.

Torpedo stowage and handling arrangements.

Arrangement of tops and conning towers for most efficient locations for fire control instruments (clear vision, etc.).

Arrangements for mine stowage and mine tracks.

Ammunition hoists and torpedo tubes on submarines.

Also co-operation with the Bureau of Engineering regarding:

Wiring and arrangement of instruments for plotting rooms, torpedo tracking rooms, and all fire control and torpedo control stations. Generally, all voice tube and telephone leads and outlets.

33. It is desired to point out, in connection with this discussion, the very close relation between technical ordnance and gunnery ideas and ship construction ideas, as regards design of ships. Even such a matter as the construction of the enemy's fuses has a tremendous effect. We do not fire at ships merely to pene-

trate side armor or to disable personnel, but to accomplish their destruction. The protective deck is at present the most interesting target, and we cannot build our protective decks without a clear idea of what the enemy's fuse is capable of. It is believed that it has not generally been appreciated how necessary it is for the three material bureaus (ordnance, engineering, and construction and repair) to co-operate with each other in ship design.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

ADDRESS DELIVERED BY CAPTAIN McNAMEE ON APRIL 4 TO NATIONAL COUNCIL FOR REDUCTION OF ARMAMENTS

Mr. Secretary, Officers of the Council, Ladies and Gentlemen:

I thank you for your great kindness in permitting a navy man to occupy a few minutes of your valuable time in presenting for your consideration my views on the subject of the navy and the 5-5-3 ratio. The views that I express are my personal ones and carry with them no departmental authority or responsibility. I am a reader of your *Bulletin of the National Council for the Reduction of Armaments* and I assure you I find it filled with sentiments of the very highest and noblest altruism. I will go further and say that its arguments are so cleverly and logically prepared as to make the most dyed-in-the-wool militarist pinch himself in order to wake up before he is converted.

I am not a militarist—I am down on militarists from the Kaiser to the last Hans or Fritz.

We, of the regular army and navy, love peace and hate war, because we, above all, know what it means.

In my long experience in the navy I have had occasion to note that when international friction arises through some unfortunate incident the most belligerent expressions in the public prints are not from the army and navy, but usually from those who are opposed to efficient armies and navies and frequently the most rabid of all come from the pulpit.

We have just ratified a treaty by which we have made the greatest sacrifice and the greatest renunciation ever made by a nation in the cause of peace—we have agreed to scrap twenty-eight battleships, thirteen of which, now building, were to be the most powerful engines of war ever conceived by the mind of

man. We scrap property of a value estimated at over a third of a billion dollars. We renounce for a generation to come the power to be the reigning mistress of the seven seas. We, of the navy, approve of the sacrifice and of the renunciation. Competitive building against friendly nations with whom we desire only friendship and goodwill is unnecessary, extravagant and ill-timed, when in its place we can substitute an agreement whereby our present porportion of relative strength may be maintained. It is no secret that the naval treaty would not have been practicable without the whole-hearted co-operation of the navy, which assisted in devising a technical plan that made possible the undertaking of our great secretary of state.

The plan that proved so successful was based on a fixed ratio of strength in capital ships, giving equality to Great Britain and the United States and three-fifths of such strength to Japan. This is known as the 5-5-3 ratio. If you had seen and understood the time and care that was devoted by the representatives of all the powers to the exact tonnage and exact ships by name that went to make up this ratio you would perhaps be less prone to treat it so lightly and proceed to toss it aside as a paper triviality. The ratio expressed was the minimum proportion that each nation should have in regard to the others in order that the national safety might be assured. Our delegates cut to the bone and went to the very limit in generosity. The sacrifices of the other great powers were less than ours. Great Britain had no new ships to scrap.

Nothing was said as to the number of personnel in the several navies, it being assumed that this was adequately limited by the number of ships. But it must not be forgotten that men fight and not ships. That historically good men in poor ships have invariably triumphed over poor men in good ships and that ships themselves are but inert masses of steel and machinery that are helpless in war unless manned by trained officers and men. These officers and men can be trained only in time of peace. When war comes it is too late. It is a life work for an officer and years for a man, and unless ships are assembled in fleets and we learn how to co-ordinate aircraft, surface craft, and submarines for battle we will be ignorant of our profession and bring humiliation, dishonor, and disaster upon our country in time of need. A modern navy

is not something that one can take out of one's pocket when war breaks out and then toss merrily on the scrap heap when the war is over. Navies are the first line of defense and must be ready for instant use since history shows that naval attacks may precede a declaration of war and go far toward deciding its issue. Great Britain proposes to reduce the total *enlisted* strength of the Empire to 104,000 by April, 1923, a year from now. Her crews are old and seasoned with twelve-year enlistments. Ours are boys with an average age of about twenty years, with two-to four-year enlistments. In addition we have to man our tankers, repair and hospital ships with regular sailors, using up a valuable part of the regular force, while Great Britain now mans these ships entirely with reserves and merchant sailors that are not counted in her enlisted strength. Japan proposes to reduce her enlisted strength to 68,000, although she is allowed only three-fifths of our strength. This would give her 1,000 more men than you would give us. In other words, you are trying to scrap the principle of limitation by agreement and substitute in its place a principle for which no responsible statesman has ever stood, the principle of limitation of armaments by example.

It is very easy to give advice and to urge the adoption of beautiful dreams, knowing that those who are charged by their fellow citizens with the responsibility for the safety and defense of this country will not adopt your recommendations unless they are safe. But you, ladies and gentlemen, are responsible and influential citizens and voters and should not shirk your responsibility in this way. Until you have studied both sides of this question and have asked yourself why it is that no responsible statesman is advocating disarmament or limitation of armaments by example I beg of you not to sign petitions advocating a policy which you, in office, would not dare to carry into effect. Not one of you sitting here, were you in authority, would dare to disarm this country, or to ruthlessly reduce armaments, as a hopeful experiment.

I beg of you all before you go further in this matter not to take my word for it, but get from the government printing office "The Naval Policy of the United States" as announced by our Presidents in state papers from George Washington down to present times. You will find that every single President has

found it necessary to urge upon Congress the absolute necessity of a strong and efficient navy. Does this mean nothing to you?

Congress must represent the people. It must give what it thinks the people demand. Be careful what you demand—you may get it.

This government, like all governments, is largely controlled by active minorities. An extreme case is seen in Russia where a handful of vigorous propagandists control the masses of ignorant millions. The peace organizations of this country are in a position to do tremendous good or tremendous harm. Each of you is responsible for the demands you are making.

I read in your *Bulletin* that if we set the example other nations will disarm—I look in vain for any example that would warrant such an assumption.

We have reduced our army to a point where it is a mere fraction of the armies of the great powers. Have they followed our example? France has over 600,000 men; Great Britain, 562,800; Italy, 300,000; Japan, 300,000; Belgium, 120,000; Czecho-Slovakia, 215,000, and even Roumania with 190,000 will have 90,000 more men than you now propose to give the entire United States with its dependencies.

Does anyone imagine that if France disarmed in 1913 Germany would have followed her example? I will not labor the point further. No responsible statesman could ever propose such an experiment. The only principle that has ever scrapped a gun is the principle of limitation by international agreement. If you stand for further limitations by international agreement I am with you. But if you wish to limit by example I call your attention to the condition of China, which stands as the world's great shining illustration of the results of limitation of armaments by example—a perfect example of the effects of pacifism and non-resistance. The profession of a soldier there for ages has been looked upon as lower than that of a coolie. But experience is bearing some fruit and China is waking up. We can hope that the time is not far distant when she will stand on her own feet without assistance from anyone. When that day comes I think there will be some difficulty in persuading China to attempt another adventure in helplessness. There is some food for thought in the fact that the most peaceful country in the world is Switzer-

land although every man there is taught the profession of a soldier.

The point of departure between the views of responsible statesmen and of those who would advocate disarmament lies in their different conception of the actualities. The statesman must deal with the world as it is, while those with the vision of idealism deal with the world as it should be. These two points of view account for the great confusion of thought that now exists in the world and has its analogy in the medical profession, where a reputable physician deals with the disease, while his quack rival ministers only to symptoms. The great American public is prone to approach every great trouble from the point of view of its symptoms. If the weather is bad and the crops fail the political party in power is held responsible for the failure. If there has been a great war and taxes are heavy the blame falls on the party that must levy the taxes.

We may wonder why a nation that a few years ago was calling enthusiastically for the largest navy in the world should appear today to be calling for complete disarmament. The cause is not far to seek. History shows that it is the psychological sequel of all great wars. The world wakes up from an orgy of war, raises up its right hand and says, "Never Again!" I trust this time with more sincerity than many a good citizen (before the eighteenth amendment) awoke in the morning and gave voice to a similar sentiment.

I wish to emphasize the point that in talking disarmament we are talking of a symptom and not of a disease. Great armies, great navies, and great guns are not what ails the world. They are symptoms that will endure until the disease is cured—that disease is international injustice and oppression.

The basic causes of war lie in congested population in one country and under-population in another, the struggle for the world's raw materials, the exploitation of weak nations, low international morality based on motives of fear and interest, and racial hatreds.

I cannot believe that we are no better than charlatans with quack remedies, treating symptoms as they arise, and that we lack the moral courage to strike at the root of the disease itself. Burglaries are not committed because burglars have the tools. The

tools exist because there are burglars. When the burglar reforms his tools will be found upon the scrap heap, but no burglar was ever reformed by taking away any or all of his tools.

In all its history our navy has never caused a war, nor tempted any of our citizens to go to war. In our country Congress, backed by public opinion, makes war. Armies and navies make peace.

To those who still harbor the belief that the navy is a millstone around the necks of the people without cause or excuse in time of peace, I wish to point out just a few facts of which our citizens are in astonishing ignorance.

The people of our country spend annually for all purposes about $50,000,000,000. Taking $400,000,000 as a proper expenditure to maintain our navy, and which is twice what your *Bulletin* would give us, it means that for every dollar we spend on a navy we spend $125 for other purposes. The figures for 1921 indicate that we spend nearly a billion dollars a year for soda water and confections. Enough is spent on chewing gum alone to support the navy. It is claimed that we spend much for navies and little for education. It is no function of the federal government to maintain schools, but there is spent for education annually by the people of our country more than one billion dollars. The federal government is the only agency charged with the duty of providing for the common defense, it is one of its principal duties and it is not surprising that about ten per cent of the federal budget should go to the navy.

Compared with rates before, the taxes are indeed burdensome, but they are not spent on the navy. If you paid an income tax of $100 this year the scrapping of our capital ships will enable you to deduct on that account just forty cents next year. Your income tax will be $99.60. New York City alone pays an annual tax of $613,000,000 and has a debt of over a billion dollars. A holiday in building battleships will reduce taxes in New York City from $100 to $99.38.

As the bulk of federal revenue is now raised by income taxes, the farmer and the laborer scarcely feel it.

We need economy and no effort should be spared to enforce economies in government expenditures, but I can assure you that the navy has gone the limit in this respect. Our whole fleet

is now practically immobilized to save fuel. However, a country that is rich enough to hand out a gratuity of three to five billion dollars in a soldiers' bonus can hardly begrudge the few millions that mark the difference between the minimum to preserve efficiency, that is, 96,000 men asked for by our secretary, and what your *Bulletin* is now advocating.

Whatever conception foreign powers may have of the mission of armaments we know and they know that the American idea of the business of armed force is to maintain law and order, to prevent tyranny and injustice, to protect the helpless, the half-civilized and the savage. Our conception of the function of force is to give moral ideas time to take root, but that force should be sufficient to insure that a breach of the peace should not promise desirable results to anyone. We cannot do this without maintaining the navy that the treaty gives us.

We stand today charged with a heavy responsibility. We are one of the great custodians of civilization. If we are shorn of our strength by the opiate of foolish optimism the power for good will pass to others with more selfish motives.

We American people are the most idealistic, altruistic and optimistic in the world. Not because we are inherently better than anyone else, but because we have our ambitions satisfied. Wanting nothing ourselves we sincerely seek the good of others. Shall we sacrifice those who look to us for light and protection? Sea power and civilization have gone hand in hand since the dawn of history. The sea power of Holland, France, Portugal, Spain and Great Britain have carried Christian civilization around the world. Today the American navy controls and operates our world radio communication, it furnishes the charts of our mariners. It controls and operates the radio compasses that guide our great commercial fleets into our ports in storm and fog. It is guiding, instructing and protecting the natives of Haiti, San Domingo, and the Virgin Islands, where it has stamped out revolution and reduced the death rate to a figure equal to the best we can show in our home country. It has increased our trade in the Near East through the protection of our destroyers by over 1,000 per cent. It has earned the highest commendation of Mr. Hoover by its spontaneous effort in all European relief work. It is protecting our missionaries and our trade in the far reaches

of the Yangtze-Kiang. It is our standing guarantee of the integrity of the western hemisphere against the aggression of any foreign power. Never in its history has our navy meant aggression or injustice to anyone. It has stood ever as the benevolent strong right arm of the government extended only to sustain and protect.

If we expect a great merchant marine to carry our surplus products over the seas we must have an adequate navy to protect it. The two go hand in hand, as every nation has found by costly experience. Political economists tell us that war is but the ultimate form of economic competition. If we are to compete in the world's markets let us see that our weakness does not tempt our competitors to paralyze our foreign trade.

We have seen the tremendous asset our sea power was in the negotiations of the conference. Having a great navy we were in a position on which to trade. It was not so difficult to induce the great powers to reduce their navies when the alternative meant the continued superiority of our fleet. With an inferior navy what inducements can we offer at the next conference? Beautiful as were the reasons of humanity, altruism, and idealism advanced by our people in favor of limitation of arms, they could have been as ably presented by any minor power that possessed not even a solitary gunboat. Whether we like it or not the fact remains that when nations assemble around the council table the one with the greatest background of armed strength still receives the most attentive hearing.

We entered the World War to make a war to end war. That struggle ended in victory, leaving us the richest and most influential nation in the world. We desire now to make the holy purpose of that war a living truth. We ask none of the spoils of war. We crave only the privilege of co-operating with enlightened and free nations for the good of mankind. We long to remove the causes of friction that incite wars. Let us not lose the influence of our strength in the councils of the world till this noble purpose has been accomplished.

Having stated that arms are a symptom and not a disease I am going to make bold to suggest a remedy for the disease itself. I make no claim to originality.

It is a remedy which, in my opinion, is practicable. It is one in which honest men of every race can find nothing but good. I commend it to your earnest attention. Its object is to substitute a reign of law for a reign of force. Let us assume that a reign of law rests on three elements, a law, a court, and a sheriff.

Let us assemble the civilized nations of the world and codify international law. A code that will prescribe the rights and duties of nations in all their relations. Let us all sign a treaty adopting this code. Let us establish an international court to interpret these laws and hand down final decisions. Let us sign a treaty agreeing to be bound by these decisions.

Next let us not wait for a thousand years till the world is ready to accept an international sheriff but let us all sign a treaty agreeing to treat as an outlaw any nation that refuses to be bound by the decisions of the court.

This appears to be an entirely logical procedure. The injured nation then would have the same rights as a sheriff in the enforcement of the decree, while the nation in contempt of court would have only the rights of the outlaw or the bandit. While armed force would still be necessary it would be force used only in the enforcement of the law.

Here is something tangible and practical but it requires courage to boldly attack the disease itself when it is so simple to palliate symptoms even if thereby we aggravate the real malady. Limitation of armaments can only be a palliative justified principally on grounds of economy. Disarmament of the world at this time would mean universal chaos. I would have you, ladies and gentlemen, turn the great power of your organizations to the real constructive measures that a war-weary world has awaited so long in vain, a practical method of substituting a reign of law for a reign of force.

In closing, I do not wish to give the impression that I am a pessimist. I have faith in Congress and in the American people. I know that they believe in our navy, they realize it is their first line of defense—that with their great wealth the support of the navy is an insignificant burden upon them. They realize that the American navy has never caused a war, but that it is in constant use to prevent war and to protect the oppressed.

I cannot do better than to quote our beloved Secretary of the Navy in his recent message to the American people:

"The American people want a razor-edge navy ready for battle at any time, not the largest in the world, but second to no others. If we are to sit at the first table in the councils of the nations we must have such a navy. The Conference on Limitation of Armaments provided for such a navy. Why not insist that we have it?

"Whatever armed forces have cost us they have made and kept us a nation. When we can live without fire, police, and health protection, it will be time to discuss giving up the navy. When we can dispense with insurance we can dispense with the navy.

"The United States and the world need the American navy. Let's keep it a good navy."

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MORALE AS IT AFFECTS THE LEADERSHIP OF A DECK OR ENGINEER DIVISION

By Lieutenant Ernest G. Small, U. S. N.

The signs of the times point to a more intensive cultivation of personnel in the naval service. From immediately after the Spanish war until the present, the development and increase of material has far out-stripped the personnel furnished to operate it, with the result that more directing energy has gone into the preservation of material than should have been necessary. With the decrease in the number of capital ships and other limitations, one may hope that the training and leadership of personnel will receive more intensive study than it has heretofore.

Before the word morale is relegated to that limbo of overworked words along with efficiency and psychology, and consequently before it has lost its savor, I should like to express some ideas as to how morale affects the leadership of a deck or engineer division on shipboard. If the word morale conjures up the vision of a highly centralized departmental bureau or division having its outward manifestations in morale officers, boxing bouts, chaplains and Red Cross workers; a sort of machine that produces neatly tagged packages of morale, I have nothing to offer. It is typical of human nature, and we of the naval profession are no exception, to want to get something for nothing. Morale is not attained in this manner, but rather results from intelligent and laborious work. I shall attempt in this paper to map the problem of the division officer in building up morale, and suggest some methods of achieving it. I have nothing new to offer, I am merely re-starting age-old facts.

What is this morale of which one hears so much? All the authorities agree in striking unanimity. "Moral or mental con-

dition as regards courage, zeal, hope, confidence, and the like; used especially of a body of men engaged in a hazardous enterprise as soldiers or sailors in the time of war"—so states the *Century Dictionary* and the *Webster* and the *Oxford* definitions are practically identical. Language is such a living, growing thing that words push beyond the meanings hedged about them by academicians. Morale has come to mean more than is here stated. It must exist in peace as in war. It is the unceasing will to achieve in a body of men under all circumstances expressed as if it emanated from a single resolute soul. It suggests voluntary co-operation, an ability to give a little here and there but always to advance, and above all it suggests intelligence. There is nothing passive about it, no posturing with "head bloody but unbowed," but rather the wresting of the club from the hands of adverse circumstances. The problem then before a division officer may be recast in engineering terms as follows: "To design and build a moral or mental condition in a group of men with sufficient factor of safety that this condition remains intact under all possible stresses of peace and war suffered by individuals of the group, short of death itself."

The literature of morale is prolix in negative principles; but it is not very rich in a positive way. I mean by this that we are told almost to the point of wearisomeness that if we do certain things or allow certain conditions to exist, or fail to do certain things we will destroy morale; but we are not told that a healthy morale will positively flow from following concrete directions. I suppose this is true because we are dealing with the minds of men, more particularly with their emotions; because at best our position is similar to one cultivating a garden: he can plant and tend, but he must count on the soil, water, light, and heat to do the major share. There are certain fundamental negative conditions that affect the morale of a ship's division which I purpose to discuss in the order of their importance. In this discussion I shall attempt to point out the division officer's responsibilities for an equitable adjustment of these conditions. These factors are money, food, shelter, working conditions, clothing, and leave and liberty.

MONEY

Let us consider money. I was much struck once on hearing a gentleman begin an address before a college Y. M. C. A. on the choice of a profession by stating that the first consideration should be the rewards that the profession has to offer. Such apparent cold-bloodedness amazed me in a meeting of that sort. The speaker went on to state that no matter how altruistic a man might be his influence in a community was nil unless he adequately provided for his family. Whether we consider it from an ethical side or not, money is a powerful factor in men's lives. This is especially true in the United States, where money has been eagerly seized as a convenient gauge of a man's success. With Congress fixing the rates of bluejackets' pay, and a supply officer disbursing it to the men, there seems little that the line officer has to do with money; but this is a superficial view. In the first place, he can always throw the weight of his influence for adequate remuneration, for he must realize that it is a powerful incentive to men. Second, he should be fairly familiar with the pay tables so that he can advise his men in any question of payment, without bothering the usually overworked pay force. This has a surprisingly good effect in letting his men feel that he knows something about what concerns them vitally. Third, he should be always on the alert to insure prompt payment. This may take the simple form of seeing that the division is assembled promptly for pay, and that provision is made for obtaining the pay of men engaged in duties elsewhere. If it be true that time is an important factor in decisions, it is also true that time is a factor in the payment of money to men. The average man, broke on pay day, does not enjoy waiting a day later for his pay because he happens to be loading provisions on a dock at the pay hour. To those who served on small vessels in the war, carrying no pay officers, it is needless for me to recall the great hardships suffered by men and their families due to delayed payment of money, and its lowering of morale. The memorandum pay roll seemed the best solution. In this connection let me observe that a supply officer is but human. The thrusting of a memorandum roll on him, and the payment of a hundred men from another ship, bringing more work to his possibly scanty force, he does not enjoy. The navy regulations require that a letter be

addressed by the commanding officer of the ship carrying the memorandum roll to the senior officer present afloat requesting that a supply officer be designated to pay the ship. To you executives of small craft, I suggest you follow this method to the letter, and you will never place yourself in the humiliating position of begging money for your men, nor will you be informed that it is being done as a personal favor to you. Fourth, having a knowledge of pay tables, a division officer giving due consideration to the interests of the government may often be able to obtain extra compensation for a good man, and may use his knowledge to clean out a nest of sinecure holders.

Closely allied to the question of money, is that of promotion. Owing to frequent changes in the complements of ships, the tendency has been noticed of men to assume that promotion is something that can be demanded, and not earned. This idea should be ruthlessly crushed. On the other hand, the crushing of this idea requires that the division officer make every effort possible to promote a worthy man before he nurses a grievance. No man should ever have to ask for promotion. A state of affairs should exist such that every man knows that he will be promoted if a vacancy exists and if he is worthy, and if he is not promoted, it is because of a failure of one or both of these conditions to be fulfilled in his case.

FOOD

The matter of food is particularly in the province of the supply officer. On most ships there are four persons who are keenly alive to its importance: the captain, the executive officer, the supply officer, and the commissary steward. I do not mention the men themselves. All of us know that certain ships have reputations as good feeders, and that certain commissary stewards are looked to with the veneration that is usually only accorded to professional baseball stars. The division officer's part is to occasionally, not too often, walk through his part of the mess deck, preferably at breakfast or supper. With an ear to the ground, slight observation, and some tact, it is possible to smooth matters in the way of food to a considerable degree. A great deal depends on the manner in which these observations are made. No high and

mighty attitude will do, nor will the other extreme be effective, for it is human to complain needlessly. The officer must strike a happy medium of sympathy and justice. A little humor goes a long way here. The old custom of removing the cap while inspecting conditions should be followed.

SHELTER AND WORKING CONDITIONS

Someone has pointed out that bluejackets spend their time either lying down or standing. That, to most of us, delightful intermediary position of sitting with feet on a lower level, is in a large measure denied them. The installation of a reading room for the crew has helped matters somewhat, but at best conditions in this respect are bound to be poor. A battleship may be likened to a town of fifteen hundred people. No one likes to go to the town library for the sake of a seat. Without increasing the fire hazard and without messing things generally, it is possible to encourage the placing of chairs somewhere in the division's part of the ship. This is worth study.

Conditions being what they are, a great deal of thought and effort must be put into the planning of berthing space. The first lieutenant cannot adequately look after the berthing comfort of every man. He can block out space to divisions and indicate in a somewhat broad way their limitations. The division officer can and should see that every man in his division has ample swinging space, and a supply of fresh air. I shall never forget when on a midshipmen's practice cruise I was expected to swing a hammock in a space eight inches wide. Such a problem was too much even for the executive officer. However, he told me that I had to swing there. Of course I did not. I wandered off elsewhere, to a place where I had no business going. A problem involving a group of individuals must be solved by one person capable of estimating it in all its aspects. If he fails, or neglects to solve it, the individuals concerned solve it with consequent chaos.

Bearing a close relationship to shelter is the guarantee that every man's personal property be immune from the depredations of others. I am quite aware that this is a subject that one ordinarily does not discuss in a paper of this kind. Theft is not a product of high morale. On the contrary it will kill morale

as quickly as any agency known. Should an epidemic of this sort break out whether by means of a draft of men newly arrived on board or otherwise, an intelligently planned campaign should be carried out to catch the culprits; and certain and sharp punishment should be meted out to them by the captain. The co-operation of the entire ship's company must not only be enlisted, but drafted if necessary. The most effective method is by increasing the number of the ship's police. I believe that the expectation that the men will form volunteer police on their own initiative or through encouragement is not only unfair to them, but thoroughly unsound in that it presupposes a co-operative form of democracy in a government that in theory and practice should be a benevolent autocracy. The part of the division officer in the event of this contingency is to state the case to the executive officer, and to bring all the influence he can muster on the side of increased protection for his men. He should also hold frequent bag inspections, and report all cases of men having the clothing of others in their possession. He should never forget that theft is one of morale's greatest enemies, and that as long as it exists in the ship, all his other efforts in morale building are nullified.

Every man is entitled to decent working conditions. Generally speaking working conditions are decent in the naval service. Preventable hardship has no part in a morale-building program. The hardships of going to sea have been materially lightened, but there are still enough to toughen the physical and mental fibre. Working men in wet clothing or feeding them at odd times when either evil may be avoided by judicious planning indicates poor management. When hardships have been reduced to the unpreventable minimum it is time to drive if need be, and drive hard. The division officer should be keenly alive to the possibilities of improving working conditions.

I can best illustrate the point just made by describing an occurrence in one of our late superdreadnaughts. The men operating the evaporators there, on live steam double effect, worked in a moist atmosphere in which the temperature averaged 130° F. in a temperate climate. Needless to say their efforts were listless and the physical condition of the plant wretched. An attempt to operate on auxiliary exhaust steam failed because this method could not produce enough water for normal consumption.

Investigation showed that the inlet auxiliary exhaust line was too small. In spite of almost insuperable difficulties the engineer officer obtained permission to make the necessary changes in piping, and carried out the alteration between times in port. This change resulted in producing enough water by this method, and brought down the working temperature to 95°-100° F. From being an eyesore, the evaporator room became somewhat of a show place. The increase in the morale of the evaporator gang could not be measured.

CLOTHING

Manners maketh men, but clothing has a share in the process. If this statement is hard to believe look on the thousands of men who persist in staying in the lowest ranks of the clean collar class with no hope of advancement, rather than cross the divide into the mechanic's class with its increased monetary rewards, but loss of the badge of class. But I have no desire to present the philosophy of clothes. Carlyle has done it much better. I do wish to bring out that neat, suitable, and abundant clothing stiffens a man's backbone. In the naval uniform we have something that answers these specifications in the main. The difficulty that clothing presents in the navy is one of administration chiefly. Consider the problem from the point of view of the man. He is told that he must wear regulation clothing. To get it, he frequently has to stand in a long queue, occasioned by inadequate service in the ship's store. When he gets it, it is regulation clothing but likely enough it will not fit him. He does not know that the ship's tailor is required to alter it without charge to him, and if he does know it, he finds the latter very much overworked, or very prone to be absorbed in a more lucrative job. On the other hand, he sees a shore tailor close by the boat landing whose shop he can enter at any time, leisurely smoke a cigarette, choose his clothing, and if the desire strike him, indulge in a few vagaries of uniform not regulation, a desire which, by the way, comes to all of us compelled to wear a uniform.

From a consideration of the reaction of the clothing problem on the man it must be patent that the division officer should investigate the conditions surrounding the issue of clothing. He can frequently get poor conditions remedied by the exercise of tact via the supply officer or the executive officer. Failing in

this, he can oftentimes arrange his division work so that the division can go to the ship's store as a body, at a time when it is not open to the general public. As for the so-called vagaries, such as narrow jumper collars, I have never seen any virtue in a broad collar except for the disciplinary value of conformation. Like many of the newer art forms, one must be educated up to it. However, it having been settled long ago that the broad collar is regulation, the division officer must preach it in season and out. He must do more. He must see that virtue is made reasonably easy. The worst thing he can do is to wait until the day before an admiral's inspection and then scream at his division because they are not all in regulation uniform.

LIBERTY AND LEAVE

The fact that naval life is unnatural cannot be ignored. If this were not so the comparison of Dr. Samuel Johnson relative to seafaring and going to jail would not have survived as long as it has. Morale demands that men get out of the naval atmosphere frequently. Curtailment of liberty engenders resentment, and should not be practiced except when urgent necessity requires it, and as a punishment. Either case is one for the captain. On the other hand, liberty within reason works powerfully for contentment. It is something that does not administer itself. The administration of liberty is not standardized through the fleets beyond the broad requirement of the naval regulations that fifty per cent of the crew be kept aboard to guard the safety of the ship. It is usual for the executive officer through his office assistants to regulate the liberty, using one of many systems of control. The division officer should be thoroughly familiar with the system in vogue. He should frequently examine its workings, and on discovering any irregularities quickly make representations to the executive officer on the subject. He should study the system critically and if he has any constructive criticism to offer he should make it tactfully to the same authority. Any extra personal effort he makes to get his men off the ship promptly at the liberty hour will be richly repaid in increased loyalty.

I can best illustrate the general statements just made by relating some circumstances that came under my observation as senior assistant engineer officer on a fleet flagship. The flotilla

of boats carried on that ship consisted of five motor sailing launches, and six motor gigs. The operation of these boats from the engineering side gave considerable difficulty. They were continually breaking down. Investigation showed that while some of the difficulty could be charged to failure to obtain spare parts for replacement purposes, the major share of the trouble was due to personnel. The boats were supplied with double crews from the deck force, but owing to a shortage of engine operators, the latter were supplied in the ratio of 1.5 men per boat. This meant that the engineers got ashore only every fourth day, unless the man's particular boat was in the skids for overhaul, when he got every other day liberty. The average bluejacket is no fool. He saw to it that his boat broke down when he wanted the liberty rate speeded up. On the discovery of this state of affairs, double crews were assigned to the boats, and regular liberty granted. The proviso was made and enforced, that if a boat went into the skids other than for a periodic overhaul, it was to be considered an emergency that required the retaining of both crews aboard until the repair was complete. The effect of this change was marked. It illustrates two well-established principles: namely, that frequently material troubles can be directly traced to faulty management of personnel, and that the way of the law abider should be made easy, and the way of the transgressor hard.

Leave is closely related to liberty. It is, however, something more than lengthened liberty. It gives a man a chance to get away for a time from the irksomeness of naval discipline without the ever-present worry of catching a boat to get back to the ship on time, or at least with the latter possibility relegated to a somewhat nebulous future. Every man needs leave if the service is to get from him the best he has to give. The matter of leave is something that the division officer has not a great deal to do with. I wish to point out in this connection some factors that seem to have escaped attention. The modern battleship is a highly organized community of fifteen hundred or more workers. Some of these, the deck force, engage in seasonal occupations, that is, they work at high pressure at certain times such as at target practice and during a coaling, and at other times their activities are fewer. During the time first mentioned

their services cannot be spared, and at other times they can be. There are other men whose work is not seasonal but day-in-and-day-out steady production. I refer particularly to the evaporator, ice machine, and machine shop gangs. There is never one time when their services can be spared more than at any other. Moreover, it frequently happens that when the deck people get leave, their services are in greater demand, if that were possible, that is, during a navy yard overhaul. On many ships leave is regulated as if all men were seasonal workers, and no provision made for the steady worker. Leave is given by the number as it were. The ship in theory is supposed to cease to function at Christmas and all hands go on leave. This, of course, is never done in practice. The men I have mentioned are required to stay aboard with the result that they rarely get their proper share of leave. Wherein lies the virtue of keeping an ice machine operator aboard during every target practice? Meat spoils just as quickly while the ship is at anchor in a leave port. I grant that a man-of-war exists only because of her armament, that every man on board must contribute in some manner toward making that armament effective, but I cannot see any lessening of the effectiveness of the armament if the special class of men I have mentioned miss an occasional target practice, especially as target practice is almost a continuous performance throughout the year. The whole difficulty appears to me to be the inherent one of trying to make a sweeping, general plan work without considering exceptions.

The specific part of the division officer in the granting of leave is simple. He forwards the man's request to the executive officer approved or disapproved. He should never question illness in the man's family. Better let a dozen "slip it over" than hold up a real case. Higher authority will probably detect the faking. Much depends on the manner of approving a request. Well-earned leave may be approved in a willing manner, or it may be forwarded grudgingly. The latter method never makes for loyalty.

To recapitulate, there are certain basic factors that must be properly adjusted or the whole structure of morale is weakened. These factors are money, food, shelter, working conditions, clothing, and leave and liberty. I have chosen to call these factors

negative principles because the effect of their improper adjustment is destructive; yet at the same time proper adjustment of them will not insure high morale, but will prevent an abnormally low morale.

By its very definition morale is an essentially mental if not spiritual quality. So far the factors mentioned have been for the most part purely physical. They may be compared to the sound physical body required to house an active, healthy mind. Their value lies in the fact that an observance of these principles will build confidence in the leaders on the part of the lead, an absolute essential to morale, and without which the military ideal of a benevolent autocracy ceases to be benevolent and becomes merely autocratic. The morale builder must go further and carry out certain positive, more intangible principles to make his structure complete. These principles, necessarily more elusive than the physical are not as capable of as precise definition or treatment. They are: fitting the man to the job, explaining the man's relation to the whole organization, the why of orders, truth in intercourse, courage, tenacity and zeal, and the part of the officer. I shall endeavor to point out their bearing on the division officer's problems.

FITTING THE MAN TO THE JOB

The human raw material coming to any ship's division is varied. It is, however, almost universally young and possessed of a common characteristic, restlessness. The first essential is to get the round pegs into round holes, and the square pegs into square holes. This can be done best by the officer making himself thoroughly familiar with each man, watching him closely under varying circumstances, and recording his characteristics in a simple card index, one card to the man, wherein is recorded all his official history and as much of his unofficial history as can be obtained, together with a summary of his salient characteristics. The late William James in an illuminating piece of self-analysis wrote in a letter to his mother;[1] "I have often thought that the best way to define a man's character would be to seek out the particular mental and moral attitude in which, when it came upon

[1] *The Letters of William James*, Edited by his son, Henry James. The Atlantic Monthly Press, 1920, Vol. I, page 199.

him, he felt himself most deeply and intensely active and alive. At such moments there is a voice inside which speaks and says, 'This is the real me!'" It is a most important task of the division officer, perhaps one of his most important duties, to find in each man what causes that man to be "most deeply and intensely active and alive," and then adapt that cause to positive naval use. The task done, military character is the result.

The fitting of round pegs into round holes calls for a certain broad-mindedness. It may be that there is no room for a particular man's talents in the division, but ample scope elsewhere. No consideration of "leaving me a vacancy" should ever prevent the transfer of the man to the place where he is best fitted to develop.

I have mentioned the characteristic of restlessness. This, a typically American trait, is to be expected, especially in men who come into the naval service. If they did not have it in a marked degree, they would never have come into the navy. This attribute frequently manifests itself in the desire of a round peg, believing his hole to be square, to want to change his hole. This is a problem that the division officer cannot dismiss instantly. He must investigate carefully. If he finds that even at the expense of some trouble he can find another round hole for the man, the change should be made, for in the long run it will pay in choking incipient discontent. Monotony in occupation and its bearing on inefficiency is being given increased attention by industrial leaders. A study of this factor in the navy is worth while. The point came to me forcefully in connection with a certain machinist's mate first class. His previous occupation was that of instrument maker. He gravitated almost instantly to the operation of a Rivett precision lathe in the battleship's machine shop. Here the quality of his work was a delight. It seemed to be an ideal job for him. After a few months he manifested great but respectful discontent. Investigation showed that he was not getting what he came into the navy for. Instead of obtaining marine experience, he was doing what he had always done but under less favorable conditions. Investigation further showed that by his excellent work he had created a demand for his services. He was engaged in manufacturing small machine parts that could be requisitioned or purchased at much cheaper cost to the govern-

ment, so that he was really doing somebody else's work at greater cost. His transfer to an operating station cheered him up, stopped a waste of labor, and allowed him to develop his knowledge of marine engineering. Every case of this kind will bear patient investigation, and will pay dividends in results. Nothing kills a man's spirit quicker than to hold him to a job, manifestly below his capacity, simply because he fills it satisfactorily.

EXPLAINING THE MAN'S RELATION TO THE WHOLE ORGANIZATION

Many billets in the navy are of necessity monotonous repetitions of the same old thing in the same old way. The average man tends to a treadmill existence, and not being a philosopher, does not see his relation to the whole organization, be it the ship, the fleet, or the navy. Systematic instruction should be given the division, explaining the relation it bears to the ship, and the relation of the ship to the fleet. Emphasis should be laid on the fact that the whole is but the sum of its parts, and if any part fail, the whole fails; and that these monotonous jobs are necessary parts of the whole. Notwithstanding we live in an age of advertising, the bulletin boards have not been developed to their full capacity. There is a big field open in using the bulletin board to "sell ideas." They are used concretely to stimulate interest in competition, but their use can be extended much further. Consider maneuvers. I venture to assert that the average man pays no attention to them, or if he thinks about them at all, believes that they are designed for the peculiar entertainment of admirals and captains. A popular exposition of this subject in the form of a five-minute talk at the close of loading drill, or a simple diagram put in the division bulletin board occasionally will help to keep men going steadily in their daily grind. Man does not live by bread alone. Monotonous work must be salted with ideas.

THE WHY OF ORDERS

The average American youth is not distinguished by a passionate desire to obey orders. Quite the contrary, he does not like to obey orders. However, once it has been ground into

his consciousness that orders are not given to annoy him, but because a positive necessity exists for them, he is keen to obey. This happy state of affairs can be reached only by patient teaching. Mr. Fred J. Miller, in a paper read before the American Society of Mechanical Engineers, said,[2] "In a recently published magazine article the difference was clearly shown between the having a foreman tell a group of workers that they must work overtime and, on the other hand, allowing the workers themselves to pass to each other and read a letter from a customer saying that unless his order was shipped by a certain date he would consider himself at liberty to cancel it. The workers decided to work overtime to prevent cancellation of the order." This illustrates my point pretty well. I want to make clear that I am not advocating the "sovietizing" of a military service. We all realize the necessity for instant obedience in the navy, even at the expense of considerable pain to the individual; but to reach this state occasional explanation of the necessity for an order, or orders, is desirable with the American temperament. Confidence in authority can be obtained quickly in this way.

Useless orders tend to destroy confidence. I am convinced that seniors irritate juniors more by encroaching on the sphere of the subordinate's initiative than in any other way. This irritation is not peculiar to the ranks of the commissioned. All of us have seen an officer change the method of a petty officer for one of his own not a bit better and sometimes worse; and we have noted the look of irritated and weary patience with which the petty officer made the change. Often enough the order has been given not to the petty officer, but to one of his men, adding insult to injury. To sum up, men must be educated to obey orders, useless orders must be eschewed.

TRUTH IN INTERCOURSE

In all dealings between division officer and men there must be absolute frankness. This is commonly expressed as "laying all the cards on the table," but I prefer that fine phrase of

[2] "Prevention of Waste in Industry," address delivered by Mr. Fred J. Miller at annual meeting, December, 1921. A. S. M. E. *Mechanical Engineering*, Vol. 44, No. 1.

Stevenson's "truth in intercourse," it so squares itself with the military ideal. All men hate to be fooled, and just as thoroughly do they hate a fourflusher. It is best to know, better to confess ignorance of a point, and worst of all, to bluff.

It is somewhat of a commonplace that men are not deterred by the difficulty of a task. Usually difficulties spur them on. Practically all writers on morale agree on this, but something more is needed. The leader must frankly admit to his men the difficulties of the task. If he attempts to belittle it he immediately arouses opposition. Wounding a man's intelligence is just as fatal as killing his pride. The leader must admit the difficulties, and proclaim his faith in the ability of his men to overcome them. I have seen the truth of this statement exemplified on several occasions. The most striking was the case of an engineer officer who was faced with the care and operation in active commission of one of our most notoriously poor destroyers. After inspecting the plant, he called the engineer's force together, and publicly admitted the worst that could be said of the plant both as to design and workmanship. He went on to state that it would be necessary to work them overtime frequently, that on many occasions the deck force would have liberty when they would not, but that he believed that they could make that ship run, and that some day they would get liberty when the deck force did not. The men responded to the appeal. That ship went six months out of Queenstown without a breakdown serious enough to force her back into port, or to cause her to lose a trip at sea, when better designed and better built craft broke down. It took sixteen months to redeem the promise that the engineer's force would have liberty when the deck force did not, but it was redeemed. To a surprising degree men react as they are treated. If they are treated like children, they act like children. If they are treated like men, they act like men.

Frankness suggests courtesy. Politeness and firmness are not incompatible. I shall never forget the extremely courteous manner with which a British captain issued an order to one of his men. He used the word "please," I remember. I was somewhat surprised, but as I thought about it afterwards, I had a distinct recollection of a tang of discipline about that "please."

COURAGE

Heretofore everything I have had to say seems to have had some bearing on confidence. But what of courage? There can be no courage without confidence; but with a foundation in confidence, courage follows. Courage seemed so common in the late war that there is a tendency to underestimate it, especially physical courage as contrasted with the so-called moral courage. There is need for both in the naval service. Psychologists tell us that fear is due to ignorance of the unknown. If this be true, the custom in navies of former times of having men witness the slaughter of animals for food, to habituate them to the sight of blood, was a crude realization of this truth. Peace training should simulate war as far as reasonably possible, to the end that the unknown factor be hunted down. I do not mean that this should take the form of undue severity or extreme hardship, but that everybody should be on thinking terms with war, men as well as officers.

TENACITY AND ZEAL

Peace-time training affords every opportunity for drill in tenacity and zeal. There should be no sharp transition in regard to these qualities from peace to war. There is possibly a slight danger that tenacity and zeal be carried too far and end in needless hardships; but not much. Needless hardship is stupid. Stupidity in leaders kills confidence.

THE PART OF THE OFFICER

The division officer, the last commissioned link in the chain between higher authority and the man, is in a position to see the latter's outlook. He should constantly strive to sense it, and endeavor to change it where necessary. He can do this only if he possesses the faculty of transplanting himself into the man's position, literally putting himself in the latter's boots and reconstructing his reactions to the reactions of the man. I was once a messmate with an officer who had this characteristic in a marked degree. He had a positive genius for getting the outlook of the men. "Mr. X ain't like other officers. He's too common," said one of his men. His ability in this direction was so unusual that to some it seemed unofficerlike.

The faculty of catching the point of view of the man does not mean that an officer is handicapped. It is a great asset, but it must be balanced by superior ethics. It is quite possible that some of his subordinates, specialists, know more than he does of certain subjects; but in morale and ethics he must be superior or his leadership fails. This may sound snobbish, but it is, after all, the foundation of a military aristocracy.

Loyalty has been preached and preached, but the usual preachment has narrowed to loyalty up. Perhaps this greater emphasis on loyalty up is necessary; but loyalty down can never be forgotten. The division officer should never forget that his division is his gang, that he is their leader in fair weather and foul, and that if he does not specially represent them on certain occasions, nobody will. To gain loyalty, he must be loyal. On the other hand, his sense of proportion should prevent his ever assuming the altitude of my division, right or wrong, but my division. The great end is service of the whole ship, and the whole fleet.

A former executive officer of a battleship told me that men who by-passed their division officers and brought their troubles and requests directly to the executive officer invariably came from the poorer divisions. Loyalty down, pays.

In the course of this paper I have frequently stated that a division officer in the face of certain conditions should make representations to higher authority. This is based on my conception of the place of the leader of a large organization, as one who lays down general policies, leaving the details to his subordinates, but who exercises the additional function of review and revision. If this idea be correct, it is a paramount duty of the subordinate to point out adverse conditions, always if possible bringing a concrete solution for the difficulty. This always requires tact. But tactful dealings with seniors is without the limits of my subject.

I have purposely omitted any discussion of the value of athletics as a morale builder primarily because it seems to me that athletics is emphasized enough on the average ship, and secondarily because there is a tendency to regard sport as the easy solution of morale. There is no easy solution. In regard to athletics the division officer should steer a middle course. He should encourage participation in sport, and loyally co-operate in all organized

forms; but he should constantly bear in mind that these activities are not ends, but only means to an end.

How is the presence of high morale apparent? It is known by little occurrences such as a man's insisting on re-rolling tubes in a steam drum while at sea in submarine waters; by an old Swedish fireman one half an hour after a destroyer was nearly cut in two asking a mate, "Have dey given de word to yump yet?"; by the spirit of cheerfulness with which a division attacks a long and disagreeable coaling. It is said that it is the marketing of the last ten per cent of production that pays dividends, while the other ninety per cent pays the cost of production, fixed charges, and overhead. You may drive as high as seventy-five per cent out of a man; but he has to give the rest freely. Morale, earnestly striven for and properly cultivated, will bring out the one hundred per cent.

To sum up, morale is intimately bound up with leadership. Leadership does not exist unless morale is achieved. Morale is based on certain fundamental mechanisms of daily living in the naval service. Unless these mechanisms function smoothly there can be no morale. Morale further depends on more illusive adjustments of the individual minds of men. The division officer must first build his physical foundation, and then just as surely build up the less tangible superstructure of his edifice.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

EX SCIENTIA TRIDENS

By Lieut.-Commander C. B. Vroom, U. S. Navy

Now that Edison has invented a machine for communicating with the dead, perhaps we shall be able to savvy math.—*The Log.*

The natural reply to this variation of a standard joke (since math, in our technical profession, is very much alive), is, Well?

I

Every year the problem of education becomes a trifle more difficult, because of the increasing demands of the service. That difficulty is to be met only by consolidation and co-ordination of the departments for the purpose of cutting down duplication and consequent waste of time.

There is, however, another difficulty, one that as yet has received no consideration, or at least none that has resulted in improvement. For ourselves we admit that the basis of the alleged joke exists in fact, and that the main difficulty for immature minds (and not a few maturer ones, our own included) is the inability to look upon the several branches of science as living things, *as they are presented.*

That this difficulty exists there is plenty of evidence. In the field of pure science, mathematics for instance, nothing new has appeared for years. Yet the flood of text books continues to rise, and to date no satisfactory ones have been found. The newest differs from its predecessor in binding and arrangement, and will be succeeded by yet another in a year or two. *Its* contemporary generation of students will consider it as a tomb, and the *Log* of that day will furnish a suitable epitaph.

It is proposed to examine the subject of education from the point of view that the mission of the Naval Academy does not

change; that the material never varies; and that an educational institution that exists solely for the purpose of supplying thoroughly trained engineers (in the broad sense) does not completely fulfill that mission. That the same condition exists as regards the universities is shown by the frequent discussions that appear as the value of the university-trained man compared with the man who has not had a higher education than grammar- or high-school. Perhaps the colleges can do no better than they are doing; at any rate the majority of executives are dubious as to any special advantage attaching to a college education. It has frequently been stated that a college graduate must spend as many years learning *after* he has graduated, as the man who enters the business world as a high-school graduate. Not only that, but he frequently has to *unlearn* some ideas that he absorbs in college.

Of course the navy must have men who have a thorough technical training, that only the Naval Academy can provide. The point is, that the Naval Academy has a tremendous advantage that the universities do not have. It can turn out men who are maturer than the average college graduate; and it can see to it that there shall be no ideas to be unlearned. There is one course in the curriculum not taught elsewhere; *responsibility*. There are really two sorts of education; one that prepares the student for a definite occupation, and one that fulfills the literal meaning of the word, namely, to lead out the minds of the student. If some of the notions, ideas, and characteristics of the adolescent mind that generally persist throughout student days can be corrected *during* the course at the Naval Academy, instead of allowing the hard school of experience to do it after graduation (as the colleges are forced to do), two ends are gained; the graduate becomes of some practical value much sooner, and, *he gets more out of his technical course of instruction*, while he is an undergraduate. The characteristics of the immature mind have been summarized to include supreme indifference, a lack of appreciation of responsibility, superciliousness, and lack of judgment. All of which are childlike qualities. The imposition of *responsibility* is the best corrective.

The mission of the Naval Academy can be summarized in a few sentences; to send out to the fleets young men trained in scientific

methods and the *use* of books, with sufficient technical knowledge to become proficient in the various branches of engineering that they will be called upon to practice; and with correct ideas of personal responsibility, and a wholesome regard for the traditions and unwritten laws of the service in the matter of personal honor and conduct.

The raw material never varies, considered in the mass—at least not appreciably. One eighteen-year-old boy is pretty much like another, the world over, so far as his mental *qualities* are concerned; he may, and does, vary enormously in mental *capacity*. But he is far from being mature, whatever he may think of himself. He has the stature of a man, but several unmistakable qualities of a child. One of the most important duties of the Naval Academy is to eradicate the childish qualities. It must be recognized that to do this in four years is in itself quite a task (one that the colleges have not found possible); also that an immature mind cannot reason logically. Yet, from the first, it is necessary to begin the technical and scientific education demanded by the naval profession; to present abtruse subjects in large doses to minds bewildered, unaccustomed to reasoning, and in too many cases, not sufficiently grounded. This is the second difficulty heretofore mentioned.

II

The methods of presentation of the subjects taught have been frequently discussed; it might be said incessantly argued. Probably there are as many opinions as there are officers. As to whether officers who are not especially interested are as competent instructors as they ought to be, is another question much discussed. There is no question but that they *ought* to be as competent as civilian specialists, and there are some subjects that they are especially fitted to teach, such as navigation and ordnance. It depends largely upon the individual. There is this difference between teaching in civil institutions and the government academies; in the former the instructor *must* be thoroughly equipped; in the latter he *may* be merely a referee between the student and the letter of the text.

Are text books all that they should be? Do they present in as clear a light as possible, for the consumption of immature

minds, the essential points and facts of their respective subjects? Or do they convey the general impression given in the alleged joke at the beginning of this article? We incline to the belief that nearly all text books, especially in technical subjects, are written in a "style" best calculated to discourage a seeker after truth, let alone a harassed, bewildered youth. Lincoln's method, in analyzing the political questions of his day for the erudition of assorted audiences was "Speak so that the lowest may understand; the rest will have no difficulty." Not a bad method for educators to adopt in their works.

How many and many a time have you followed through an elucidation and brought up against "Therefore it is obvious," followed by a string of symbols that were *not* obvious? If you happened to be looking up something that you needed, you probably went to someone to explain it; but if you happened to be a midshipman, you memorized that string of symbols; it was here today and gone tomorrow, a nebulous equation without any particular meaning or connection with anything past or to come. That a proper understanding of that principle might be necessary for further use was a matter of supreme indifference.

Frequently the very English is obscure; legions of technical terms appear without the slightest attempt to define them. The student is bewildered by words of whose meaning he has not the slightest idea, used to demonstrate propositions obvious only to the writer, who assumes mental processes similar to his own, not to mention an interest and scientific knowledge that the beginner, old and young, has not got.

The argument is often advanced that digging the work out is part of the instruction. It will *not* be dug out. The student as a general rule has neither the time (especially in the Naval Academy) nor the interest (in any undergraduate institution). In elementary text books every fact should be so clearly demonstrated that any one old enough to study the subject at all shall understand it; every technical term should be clearly defined. Every reasonable means should be employed to force home the fact or principle; if homely simile or colloquial language will make it stick in the memory, then abandon the formal style of science. Plenty of seventeen-year-olds can see at a glance the theory of a see-saw, who are shy with the "theory of moments" even after

being properly introduced to it. Of course this is not propaganda to have physics set to music or astronomy put into nursery rhymes. It is simply an argument to the effect that immature minds cannot have facts too plainly set before them, or too forcefully driven home. Memory is largely a matter of association, except in the case of the parrot.

Inasmuch as nearly all textbooks used at the Naval Academy are either written or prepared (with due acknowledgement) by naval officers, the matter lies entirely in the hands of the navy. Text books come and are supplanted; the material is the same.

III

The problem of classroom technique is harder than the text book difficulty. For a given class in a given year there is *one* text book; but twenty instructors. An arrangement whereby an instructor handled about ten students would be the best, under the Naval Academy system, and further, offers the greatest possibilities. But even with no more than ten to a section, it is practically an impossibility for an instructor to assure himself that every midshipman has got the essence of the day's assignment. If the instructor attempts to answer every question that every midshipman wants to ask—those who have tried it know what the range would be—he finds that the students are adepts at killing time, and that a general discussion of the day's lesson quickly becomes a covert criticism of the course in general, and the last examination in particular—and here we have another manifestation of the childish mind. This is one extreme; the other is the system of refereeing between the midshipmen and the book. Somewhere between, lies the best method. The best has to be discovered by each instructor for himself; and this is an argument often used by those who hold that a civilian is a better instructor than an officer; by the time that the latter has evolved the best method, he goes to sea again.

Week after week, when the marks are posted, the sections run to a surprising similiarity of proficiency, due to three factors: the policy of the department as to what the midshipmen ought to do; what the instructors think the midshipmen are doing, and because the *sections* are pretty much alike. The *sections* run to an average, *but there is probably no such thing as an average*

midshipman. That is to say, in *any* section there are best minds, mediocrity, and the submerged tenth. The first run true to form consistently—superior mental capacity, industry, and maturity. The last are equally consistent—dull, childish, careless, indifferent. Mediocrity is in the majority; he is the instructor's real problem, the fellow who is trying, but cannot quite keep the pace for any one of a number of reasons that it is the instructor's duty to discover if he can. There is not much use in wasting time with the hopeless element; if it is not hopeless because it wants to be, there is always the extra instruction period. The point is to get the lesson across to mediocrity. It is easy to find out how much the bright men know; how little the indifferent or stupid man knows, but it is extremely hard to find out exactly what mediocrity does *not* know; *why* he does not, and then see to it that he does, all in one recitation hour.

The usual argument that midshipmen must be given a mark and therefore there is no time for instruction is a good one: provided the mark is intended to strike an exact balance every recitation between the midshipmen and the book. Even so, with a large number of instructors there is certain to be a wide divergence of methods, and in any case there can be some attempt at standardization, if only by informal discussion and the formulation of a departmental policy, or, better yet, a Naval Academy policy. But it is not admitted that every midshipman should have a mark every recitation, based solely on what he is able to commit to memory and retain long enough to put on the board. His mark for the month, including the examination mark, should show his *proficiency,* as well as aptitude, industry and interest. Nor does he necessarily have to know *when* he is to be given a mark, because some of him (collectively speaking) would prepare especially for the occasion, being human, and immature to boot. There is no intention of formulating a best method, but there is no harm in starting an informal discussion.

Suppose, to utilize a recitation hour to the best advantage, a section (after the usual questions regarding the next examination are answered), is given a written recitation. At the end of twenty minutes the majority (all but the submerged tenth and some of mediocrity) will have finished, and the remainder of the hour can be devoted to instruction. All the points of the

day's assignment can be brought out, discussed, *explained,* in the course of cross-examination; and incidentally points of previous lessons that have a direct bearing on the current work. Ambiguities in the text (there are plenty of them) will appear, and can be cleared up at once. Thus the individuals will not have the excuse that they cannot understand the text, but best of all, abstruse subjects will be brought to life because some interest can be injected into them, and a machine for communicating with the dead will not be needed. If marks are to be assigned, there is the written recitation as a basis.

IV

The best instrument for teaching responsibility, and for developing latent mature mental qualities, is the summer practice cruise. If conducted solely in the interest of training, it is a course with possibilities beside which the summer field courses of the best technical schools fade to insignificance. Theoretically the cruise is conducted in the interest of midshipmen; practically it accomplishes scarcely a single aim. This conclusion may seem to be a hasty and radical condemnation of a part of the Academy course that is well established and generally carefully planned. Perhaps it should be qualified in the sense that the possibilities are not attained, however well the planning may have been done. In view of the fact that the character and results of any given cruise often depend on the exigencies of the Navy, it may be that this non-attainment is unavoidable. Nevertheless the great importance of undergraduate training seems to be in itself an exigency of the service, upon which some others might be made to wait.

What can the cruise accomplish, besides the inculcation of the sea-habit and the laws of the navy? For one thing, it can take the technical subjects, even math, out of the classroom, and infuse some of the color of life into them, but only by making the student see for himself that there is some real connection between theory as taught in books, and practice in handling the machinery of a ship. Plenty of people ride in street-cars who know nothing and care less about the motors that make the wheels go round; plenty of midshipmen return to September leave with no more tangible acquisition than a handful of suitcase

labels. They have been passengers. There is no denying that they have stood watches; that is, as rather bored spectators; such interest as the street-car passenger feels when something goes wrong.

The conclusions as to the practical value of the cruise are based on the observation of seven practice cruises, including one in a sailing ship; three that were carried out in a squadron officered and commanded by officers in immediate touch with the Naval Academy; two in which midshipmen were distributed to ships of the fleet, and one for which a division of the fleet was assigned for that purpose. The latter is perhaps not a fair criterion because of the peculiarly unfortunate itinerary and enlisted personnel situation.

The best system is unquestionably the organization of a practice squadron composed of ships suitable to the purpose, not any that happen to be available regardless of fitness. Have it commanded and officered by the Naval Academy personnel. Then co-ordinate the summer's work with the Naval Academy instruction, and make that schedule as rigid as the schedule of classroom work, not to be broken except under circumstances that cannot reasonably be foreseen. Throw the note books overboard; anybody who can write can copy information out of a text book. Make the midshipmen do the work to run those ships, and rate them on ability, interest, and personal character, just as in the case of the performance of duty by commissioned officers, choosing standards suitable to the age and experience of the students.

The practice of sending undergraduate midshipmen to the fleet is the paramount consideration, the needs of the midshipmen a very small one indeed. The midshipmen gain false impressions in the fleet. As they are unable to realize that they are not officers, but officers in an extremely qualified sense, they are aggrieved if not allowed the privileges and comforts of the steerage. Last and most important, they either become stop-gaps to fill vacancies in enlisted personnel, or they are essentially passengers. They get no responsibility; no practical training with their hands (except on the end of a shovel, perhaps). Why? Because no commanding officer in a ship in the fleet is going to risk his fitness report on bad steering, worse signalling, and poor engineering performance. But steering and hundreds of

other matters are arts not to be acquired by observation or book-learning. The business of the fleet, preparation for war, can hardly be subordinated to the training of undergraduates. The result is that the midshipmen become messengers when they are on watch, or at most learn to read a stadimeter. In a *practice ship*, under proper supervision, correction and instruction, the midshipmen can make all the mistakes that every one *must* make while learning, before going out to assume full responsibility.

Furthermore, in the matter of the practice cruise, select an itinerary such that the ends of instruction, diversion, and reasonable recreation are best served. The wishes of chambers of commerce might well be made secondary considerations.

DISCUSSION

A Plea in Defense of Paper-Work

(See Page 621, Whole No. 230)

Lieutenant Commander R. S. Edwards, U. S. Navy.—I regret to read in Lieutenant Carmine's paper his opinion that our ships in the Grand Fleet took no detailed data and made no searching analyses of results of target practice; that "ships simply went out and fired and were observed if practicable"; that British ships "never bothered about observers, times, check sighting, safety precautions and the like"; that the British had a "modified" system for recording observations for target practice.

If this be the general impression in our navy, it is no wonder that there is objection to the paper-work of target practice. The British battleships did good shooting in 1918, whatever may have been the case at Jutland. If it be that they could shoot without vexing their souls with paper-work, why should we cling to the morose custom of post mortem reports?

It sounds attractive, but the flaw in the argument is that, like much of the mythology of the Grand Fleet, the story has become mixed in the telling. As a matter of fact, the British ships conducted practices in accordance with carefully laid plans—most elaborate plans in the "throw-off" firings of which Lieutenant Carmine speaks with disfavor. They had observers. They took careful records, not unlike our own. And their analyses were most minute. Our own ships in the Grand Fleet fired under our own rules, modified to some extent it is true, but not at the expense of record keeping.

The Grand Fleet, after four years of permanence of personnel and immunity from flower shows that can not be approached remotely in time of peace, had reached the state of organization and efficiency of staff work that enabled the admiral to direct target practices and other operations with so little sparking at the commutator that there seemed to be a pleasing ease and informality about the proceedings. But behind it all were careful plans, the result of study of past performances. The interpole was paper-work, not the lack of it.

The Grand Fleet in 1918 was an excellent example of the value of statistical study of operations, rather than an argument against paper-work as might appear from Lieutenant Carmine's remarks.

I disagree with the author in his suggestion for improvement in the way we handle our paper-work. It is not that our gunnery people do not study past performances. They do—most of them. And they swallow a lot of the chaff of misinformation along with a few grains of truth. Most target practice reports are anything but a history of what happened.

The business of recording a practice is as difficult as conducting the practice. When the records are made by observers that are not trained to record, as is too often the case, they are as likely to deceive as to enlighten.

The remedy for this is simple and has been tried out on many ships. It consists in having an observing party, organized as permanently and drilled as frequently as the gun crews. For example, in preparing for long range practice, detail your aft turrets to observe the forward turrets on your own and on other ships. Detail your aft fire control group to observe the forward group. On some of your drill rehearsals fire half the turrets at a time, using the other half at their regular observing stations. Require that a complete report of the rehearsal be prepared in pencil, omitting nothing that can be simulated. You will find endless mistakes in observing the first time, and who made them, and why. You can drill these mistakes out of the organization just as you can drill mistakes out of a gun crew. Then you can go to observe the firing of another ship with reasonable assurance that your report will be a study of the practice, not a useless comedy of observers' errors.

The General Board

(SEE PAGE 792, WHOLE NO. 231)

REAR ADMIRAL RICHARD WAINWRIGHT, U. S. N.—Admiral Taylor in discussing my sketch of the General Board endeavors to refute two of my statements. His quotations from the records cannot be contradicted, but it is not just to state that the question of the displacement of the torpedo boats did not come before the Board on Construction because he did not find it on record with the record of the contract dispute. It is a fact that at a meeting of the Board on Construction at which Admiral Matthews, Admiral Chadwick, Chief Constructor Hichborn, Chief Engineer Melville, and I, chief intelligence officer, were present, the question was considered and the decision was as I have stated. I am positive of this except as to the presence of the engineer-in-chief. Admiral Matthews said he would report our decision to the secretary and Chief Constructor Hichborn said he would make a minority report. I was told that these reports were made and that the minority had been approved by the secretary after hearing what Admiral Taylor calls an "absurd argument." I was told that afterwards Admiral Sampson induced the secretary to change his decision. I am the only living member of the Board of 1896 and I can only vouch for the subject having been discussed and the decision reached; the rest was told me. The records as quoted by Admiral Taylor show that the secretary first decided for the smaller boats and that after Admiral Sampson had favored the larger boats the secretary changed his decision by 66 2/3-33 1/3—not a 50-50 decision as I stated. "A remarkable illustration of the fallibility of the human memory"; 16 2/3 dropped in over twenty-five years.

As to the war plan. Like Admiral Taylor I have not searched the Hale committee's record, but I have read carefully the admirable report of that committee and that there was a plan which was lost, is established. That this plan was found in Secretary Daniels' desk may quite possibly be a "galley yarn." That there was a plan and that it was lost and not adopted is the point of importance. The character of the plan I cannot prove but the probabilities seem to favor that it was a plan for putting the American navy in condition for waging war effectively. As the members of the General Board were not prophets they naturally waited until we entered the war and could obtain full information from Allied sources before making plans or recommendations as to the employment of the fleet.

The opponents of a General Staff always raise the bogey of a rubber-stamp secretary. A proper General Staff system adds to the power of the secretary by furnishing him with well considered advice and acting for him when he is in accord with the General Staff. When the chief of staff does not act in accordance with directions he should be removed and when the secretary does not accept his advice in matters of importance he should resign. The country would then always know who was responsible for acts of importance. I believe the chief of operations under the present law would be as "wholly powerless to do anything except routine work" without the consent of the secretary as Admiral Fiske was under the aid system. The present system is stronger than the aid system from being legalized; but it is a "step backwards" as the bureaus are not directly subordinate to the chief of operations.

No law can make a good secretary but a good system stabilized by legislation would be an enormous help to a good secretary in his efforts to maintain an efficient navy and to control its operations.

U. S. NAVAL INSTITUTE

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Lieutenant Robert Wallace, U. S. Navy, Retired.

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The Institute Book Department will supply any obtainable book, of any kind, at retail price, postage prepaid. The trouble saved the purchaser through having one source of supply for all books should be considered. The cost will not be greater and sometimes less than when obtained from dealers.

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The Institute desires articles of interest to all branches of the service, including the reserve force. Attention is invited to the fact that the submission of articles is not limited to members, and that authors receive due compensation for articles accepted for publication.

All articles and discussions submitted by persons belonging to the navy for publication in the PROCEEDINGS must be in duplicate, one copy being signed by the author, which will be submitted to the Navy Department when the original is published, as required by General Order No. 46, of May 20, 1921.

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The attention of authors of articles is called to the fact that the cost to them of reprints other than the usual number furnished can be greatly reduced if the reprints are struck off while the article is in press. They are requested to notify the secretary and treasurer of the number of reprints desired when the article

is submitted. Twenty copies of reprints are furnished authors free of charge.

Illustrations Authors of articles submitted are urged to furnish with their manuscript any illustrations they may have in their possession for such articles. The Institute will gladly co-operate in obtaining such illustrations as may be suggested by authors.

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Notice Whole Nos. 6, 7, 10, 13, 14, 15, and 17 of the PROCEEDINGS are exhausted; there are so many calls for single copies of these numbers that the Institute offers to pay for copies thereof returned in good condition at the rate of 75 cents per copy.

ANNAPOLIS, MD., June, 1922

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PROFESSIONAL NOTES

PREPARED BY

LIEUTENANT R. A. HALL, U. S. NAVY

GENERAL ARRANGEMENT

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FRANCE

SHIPBUILDING.—The shipyards and arsenals are so far removed from the centres of raw material supplies that they are admittedly unable to compete for foreign contracts, although their situation is so precarious that every possible means has been suggested of enabling them to secure foreign business, without which it is feared that the shipbuilding industry will languish indefinitely. Something has already been done to help shipbuilders by reducing the railway rates on raw material, but the cost of construction is still too high to permit of builders competing with British shipyards. It is now alleged that, in hastening through the first part of its naval programme, the object of the Government was to prevent the closing down of some of the arsenals which are regarded as no longer serving any useful purpose. Instead of giving all the work to private shipyards that are badly in need of employment and can construct much more cheaply than the arsenals, these latter are to build a certain number of vessels that will require the presence of a costly naval staff. Cherbourg is to build four submarines, Brest two light cruisers and one submarine, L'Orient one light cruiser and two destroyers, and Toulon one submarine. Private shipyards will build four destroyers, twelve torpedo boats and six submarines.—*The Engineer*, 12 May, 1922.

SPEED OF THE NEW CRUISERS.—Whilst progressive officers see a mistake in the adoption of the 6-inch calibre for the 8,000-ton cruisers just ordered, and find no great consolation in the knowledge that these ships will have their artillery and motors better protected than is the case in the British *Raleigh* and American *Richmond*, they confidently expect to see France beating all speed records for cruisers, and speed in the eyes of many is the most important of strategic and tactical factors. It was not superiority in gunpower, but speed—and speed alone—that enabled the *Goeben* and *Breslau*, a relatively puny force, to escape from the Franco-British chase into the Dardanelles and thereby change the course of the war. So the

next light cruisers are to be blockade-runners and to maintain against all comers safe communications between France and her vast colonial empire. To that end special care and no end of comparative experiments have been devoted to the designing and installation on board of the eight small-tube oil-fired boilers and improved turbines that will, considering their enormous power, occupy an abnormally small share in the displacement of the future ships, as well as a reduced personnel. Each boiler will develop 12,500 h.p. under easy conditions, and the designers will be disappointed if the total motor power of 100,000 h.p. does not produce a sea speed of 35 knots, even when the ships put to sea at their full load displacement of 9,600 tons, especially when is considered the trouble taken with tank experiments with a view to determining the hull shape and lines most favorable to extreme rate of going. It has been found possible to conciliate high speed with habitability and fighting endurance. In this respect the experience of the Falklands and of the Adriatic operations has been remembered and put to good use. One or two encounters would not empty ammunition bunkers and mean powerlessness, all the more so as the new 6-inch shells have benefited with recent armour and pyrotechnic improvements and are deemed superior to the 7.6-inch projectiles at present in service. In truth, oil fuel still counts opponents in high quarters, notwithstanding the conclusive demonstrations made in the Lorraines, and coal-fuel designs have been proposed, but the problem proved unworkable, as no less than 50 boilers, echelonned over 150 metres length, would have then been required, together with a personnel of 700 men, to produce over 30 knots!—*Naval and Military Record,* 12 May, 1922.

SEA-KEEPING QUALITIES.—The presidential cruise in the 14,000-ton and 22-knot armored cruiser *Quinet* has brought to light several interesting naval lessons, and notably the value of homogeneity and high freeboard in warships. On the way from La Pallice to Casablanca, over a distance of some 1,200 miles, very rough weather was experienced, with the result that the high freeboard, roomy, and robust *Quinet* arrived alone in view of the Moroccan coast, at scheduled time and at a speed of 21 knots, having left far behind the slow accompanying liner with a full cargo of sea-sick parliamentary men and official guests, and also the escorting flotilla of ex-German destroyers of 900 tons, headed by the 2,500-ton *Sénès.* These Boche-built craft are exceedingly fast on paper, and in fair weather good yet for about 30 knots. On the other hand, they behave badly in heavy seas, and are even dangerous, for the twofold reasons that they are low above water amidships and that they feel very much, while rolling and pitching, the weight of the three 2-ton, 105-mil. guns which they carry high up on their back. If anything, matters were worse on board the 2,500-ton and four 6-inch gun *Sénès,* that has revealed herself as a fair-weather boat requiring careful handling. Their defects are not due so much to overgunning as to hasty, faulty designing, as the French *Lestin* (900-ton, 82 mètres length), though mounting a similar armament to that of the Boche-built *Delage* (990 tons, 92 mètres length), has more freeboard and is a better sea boat. The same applies to the *Aventurier* type (ex-*Mendoza*) of under 1,000 tons, that mounts four 4-inch weapons. On the other hand, it is to be remarked that those great navies, such as the British and American, known as "strategic fleets," built for the command of the sea and for extensive radius of action, have all along preferred sea-keeping power and robustness to excellence in the matter of armament; and, as a counterpart, a purely Mediterranean fleet like the Italian, with limited strategic aims, surpasses all rivals in the military utilization of displacement.—*Naval and Military Record,* 10 May, 1922.

FRANCE'S IDLE TONNAGE.—On March 1, 529 vessels of 1,102,568 tons gross were laid up in French ports. All but four of these flew the French flag. The showing of the leading ports was as follows:

	Vessels	Tons
Dunkirk	48	181,564
Boulogne	4	2,464
Havre	35	120,961
Rouen	5	7,117
Cherbourg	2	5,262
Brest	57	125,847
L'Orient	7	6,315
Saint-Nazaire	67	173,215
Nantes	50	107,156
La Rochelle	10	9,312
Bordeaux	20	46,177
Bayonne	4	3,001
Cette	4	1,774
Marseilles	116	249,306
Algiers	3	5,648
Oran	6	2,858

This fleet of inactive French vessels was made up of 286 steamers of 816,860 tons, 151 sailing ships of 184,595 tons and 82 other craft of 84,032 tons.—*Nautical Gazette*, 27 May, 1922.

INQUIRY INTO DISASTERS TO FRENCH CARGO BOATS.—French shipping circles have been greatly disturbed by the sinking on April 25 off the coast of Brittany of the cargo steamer *Député Albert Tallandier* with a loss of fifteen of her crew, while bound from Rotterdam to Brest with a cargo of coal. She is the third vessel of what is known as the *Marie-Louise* type to have foundered during the last few months and others have figured in the casualty lists.

It would appear from these disasters that the *Marie-Louise* vessels are lacking in stability. M. Rio, under-secretary of state for the merchant marine, has therefore decided to appoint a commission, composed of two mercantile marine officers (deck and engine-room), two engineers and a representative of a classification society, to look into the causes of these accidents. Pending the results of this inquiry, the *Marie-Louise* vessels, of which there are thirty in service, built for the most part in French navy yards, are to be laid up. They are small colliers of 2,170 gross tons, 270 feet long and of 39 feet 6 inches beam.

According to the testimony of the survivors of the *Député Albert Tallandier* the vessel left Rotterdam with a slight list to port which gradually increased. When the captain tried to rectify this list by shifting the cargo, the vessel keeled over to starboard to such an extent that she could no longer be righted. Shortly after she went down bow first. It is suggested that the cause of the disaster was a defective bulkhead which allowed the boiler feed water to shift from one side to the other.—*Nautical Gazette*, 27 May, 1922.

GERMANY

GERMANS BUILDING EIGHTEEN LARGE MOTORSHIPS.—According to Dr. Hans Stolzenburg, correspondent of *Pacific Ports* in Germany, there are at present eighteen large motorships under construction in German yards, of which about one-half will be completed in the course of 1922. Most of the new vessels are being built by the Deutsche Werft. This yard is constructing three freighters of 4,500 tons gross each for the Hamburg-American line, two tankers of 3,500 tons gross each, and three tankers of 2,800 tons gross each for other contractors, as well as a tank vessel of 2,300 tons gross for the oil works of Julius Schindler.

The Deutsche Werft is also building two freighters of 4,500 tons gross each with two motors of 1,700 h.p. each for the Kosmos Line. Two ships

of 9,000 tons gross each have been ordered from the Reiherstieg Schiffswerft and Maschinenfabrik, Hamburg, by the Hamburg-Sudamerikanische Dampfschifahrts-Gesellschaft. They will be equipped with two two-cylinder Diesel motors of the Sulzer type of 2,600 h.p. Messrs. Blohm and Voss, Hamburg, are constructing a motorship of 6,500 tons gross with two motors, of 1,750 h.p. each for the Hamburg-American line. This vessel was launched recently and was named *Ermland*.

A freightship of 6,300 tons dead-weight, destined for the Norddeutsche Lloyd, will be completed by the Vulcan Werft, Stettin. The A. G. Weser, Bremen, is occupied with the construction of a freighter of 6,200 tons gross with two motors of 1,600 h.p. each. Lastly there is being built in the yard of C. Tecklenborg A. G., Geestemunde, and the Howaldtswerke, Kiel, for the Hansa Line, Bremen, two motor vessels of 6,200 tons gross each with motors of 1,600 h.p.

The total German motorship tonnage is about 90,000 tons gross. In England there were 29 motorships of 133,991 gross tons under construction on April 1.—*Nautical Gazette*, 13 May, 1922.

ALLIES' BAN ON BIG PLANES BRINGS GERMAN REPRISAL.—Forbidden by the Allies to construct large aeroplanes for commercial purposes, the German Government has countered by closing German territory to all aerial transport by large planes. In diplomatic wording this means that the Germans answered the Allies: "We cannot fly and neither can you, because our restrictions will prevent the French and British extending several of their international passenger services, notably those to Prague and Constantinople."

The Germans claim that the Allies' restrictions as to size would kill commercial flying. They hope, therefore, to force a modification of the terms, so that commercial aviation in Germany may not be suppressed altogether.

Major George Neumann, a German air expert, said the Germans would keep their aeroplane technicians, but he feared there were obstacles to building large numbers of commercial planes for one or two years.

He said the present restrictions would prevent planes carrying fuel for more than three hours' flight. The only airship the Germans are building is a 45,000-cubic meter Zeppelin, intended to serve in aeronautic study, and to maintain a mail service between Berlin and Stockholm. Germany would gladly build a Zeppelin for America, Major Neumann said, but he regarded the fact that the Americans reduced the specifications to 170,000 cubic meters as a victory for the French, who had sought to block construction of airships by Germany. The construction of this craft for the United States has been begun, but is temporarily impeded on account of the metal workers' strike.

The allied control commission forbade delivery by the Schuette-Lanz company of a rigid dirigible to America. But that firm is evading control in manufacturing parts for eventual assembly in America. Three dirigibles are under construction in this manner for an American firm which intends to operate them between New York and Chicago.

The German air league congress recently was held in Muenster, 120 clubs, with a total of 10,000 members, being represented.—*Aerial Age Weekly*, 29 May, 1922.

AN ECHO OF THE DOGGER BANK.—In the *Marine Rundschau* for April place of honor is given to an article by Commander Gross—author of the North Sea section of the official history of the naval war—on the Dogger Bank action of January 24, 1915. This particular battle has been so often described by writers on both sides that its general character and most of its incidents have become thoroughly familiar to all students of naval

literature. Nevertheless, Commander Gross is able to throw some light on certain phases of the first encounter between capital ships of the dreadnought type. As one who has consistently maintained that the high sea fleet was always anxious for battle, he rather lets the cat out of the bag by quoting Admiral von Ingenohl's official report on the action, from which it appears that the German battle-cruiser sortie was planned on the assumption that the grand fleet, having been sighted near the Bight five days previously, would then be lying at its bases taking in coal, and therefore could not come out in time to intercept the raiders. The object of the cruise, according to von Ingenohl, was to sink suspicious fishing vessels in the neighborhood of the Dogger Bank, and then to push forward towards the British coast in the hope of "mopping up" our light patrols. Von Ingenohl did not add the fact—or perhaps it is purposely omitted from the quotation—that the third item in the programme was a bombardment of the east coast. Be this as it may, he was so confident of non-interference from the grand fleet that he made no provision for supporting Hipper's squadron with the battle-fleet. Dogger Bank cost von Ingenohl his post, which is scarcely surprising in view of the extraordinary lack of foresight which marked the arrangements for the expedition.

Nothing whatever was done to guard against surprise by a superior force. Although three airships lay ready for service at Fühlbuttel and Nordholz, they received no orders to ascend, and the one that did go up at dawn on the twenty-fourth arrived too late to be of any value. Had an airship preceded the squadron it would doubtless have given timely warning of the approach of Beatty's force and thus enabled Hipper to avoid being brought to action.

Another mysterious point which Commander Gross passes over in silence is why the Blücher was included in the squadron. The *Von der Tann* had been severely damaged in a collision resulting from the confusion into which the fleet had been thrown by the Christmas air raid on its anchorage in the Schilling roads, and was therefore not available for the cruise, but it was undoubtedly a blunder of the first magnitude to promote the Blücher to a place in the battle-cruiser squadron, thus reducing its collective speed to 25 knots. The very fact that this comparatively feeble ship took part in the cruise is conclusive evidence that no encounter with strong British forces was anticipated.

Commander Gross asserts that the British admiralty were able to decipher every German W/T signal they intercepted, by means of the code which the Russians had salved from the wreck of the *Magdeburg* in August, 1914, and subsequently placed at the disposal of their Allies. "We were thus playing with all our cards on the table," he adds, "while events on the other side were completely hidden from us." Dealing with the action itself he writes: "It was long believed in Germany that the British opened fire much earlier than we did, but what actually happened was this: At 9.52 A. M. the range was estimated at 200 hectometers (21,800 yards), or approximately the extreme range of the heavy British guns, whereupon *Lion* fired the first sighting shot at *Blücher*. It fell short. At 10 o'clock, soon after the British battle cruisers had taken station with every gun bearing on the target, the *Tiger* began firing single shots to determine the range, but it was not till 10.05 that Beatty gave the general order to open fire. The first salvos fell short by 1,000 to 1,500 metres, and it was not until 10.12 that the *Moltke* reported the first 'overs.' The British had scored no hits by 10.09, at which time Hipper ordered his own ships to open fire. Three minutes later *Lion* got her first hit on the *Blücher*, the shell striking the forecastle between the anchors, but doing no serious damage. At 10.14 *Lion* shifted on to the *Moltke*, while *Tiger* and *Princess Royal* continued to engage *Blücher*. It was only now that the British fire began to take effect." Hits were soon registered by both sides, but the first really

serious one occurred on the *Seydlitz* at 10.43, when a 13.5-inch shell struck the 9-inch armour of the after barbette, and, although failing to penetrate, drove a red-hot splinter inside the trunk, where it ignited a cartridge. Both after barbettes were burned out, and only the prompt flooding of the magazines saved the *Seydlitz* from complete destruction.

According to Commander Gross, the loss of the *Blücher* was primarily due to a peculiarity in her construction. A heavy shell broke through her armour deck at the most vulnerable point, viz., above a special passage in which ran an ammunition tramway for two-thirds the length of the ship, the *Blücher* being the only vessel to have this arrangement. The passage was full of cartridges, which exploded one after another, sending columns of fire up the ammunition hoists into the forward broadside turrets, which were burnt out. As a result of this disastrous hit the entire fire-control system was dislocated, communication throughout the ship broken off, and the steering apparatus deranged, while splinters penetrated the main steam pipe and brought the speed down to 17 knots. Hipper's report explains why the stricken *Blücher* received no help from her consorts. Not only had they been badly mauled themselves—the *Seydlitz* having two turrets knocked out and 600 tons of water in her after part—but it was seen that any attempt to turn back in support of the *Blücher* would expose them to attack by the British destroyers, and in any case the turn could not be made in time to save her from disablement. Moreover, Hipper feared lest another of his ships should sustain damage to the machinery, as he was still 100 miles from home. So the *Blücher* had to be left to her fate.

Summarizing the results of the action, Commander Gross finds that the German battle cruisers, despite their inferior tonnage and weight of broadside, had the best of it in the artillery duel, scoring 20 hits in all and receiving but four in return (*Seydlitz* 2, *Derfflinger* 1, *Blücher* 1), "not counting the numerous hits which the *Blücher* subsequently received at close range." It is to be feared, however, that this is a somewhat partial method of calculation. "There is no doubt," he writes,"that, in spite of this successful result, the effect of the heavy British guns, coupled with the loss of the *Blücher*, the hit on the *Seydlitz*, and the retreat of our squadron, was to create an exaggerated idea of the power of the enemy's weapons, an impression strengthened by our more numerous casualties—954 killed and 80 wounded, against only 14 killed and 30 wounded on the other side. Furthermore, it is a fact that the strategic honors of the day rested with the British. The new system of defending the English east coast appeared to have justified itself. After two unpunished German cruiser raids, the British had succeeded for the first time in intercepting the invaders with superior force and inflicting severe loss upon them." A tribute is paid to the "skillful way" in which this military success was exploited for political ends, especially by Mr. Churchill in his "brilliant" speech on the action in the House of Commons. Commander Gross denies that the morale of the German fleet suffered by reasons of the defeat, but the only evidence he adduces on this point is an extract from an Italian newspaper!—*Naval and Military Record*, 10 May, 1922.

GERMANY'S NAVAL AIRSHIPS AND THEIR WAR RECORD.—The development of the German naval airship service and its work during the war form the subject of an interesting paper by Lieutenant von Schiller in the current number of the *Marine Rundschau*, the German semi-official naval monthly. According to this writer, the dirigible airship as a naval auxiliary was in a very early stage of evolution when the war broke out. It was only after a prolonged study of the performances of Zeppelins in private and army ownership that the navy department decided to order its first airship of this type. Completed in 1913, this vessel, designated the *L-1*, made a few successful flights, but was lost in September of that year in a North Sea

gale. A second ship, the *L-2*, was equally unfortunate, being totally destroyed by a gas explosion on one of her first ascents. Dimensions and other particulars of these two first naval airships are given in the subjoined table. On the outbreak of war, therefore, the German navy had only one airship, the *L-3*, under its control, and as she was detailed to the North Sea station, an old Parseval dirigible was temporarily employed for reconnaissance in the Baltic. The command of the naval airship section (Marine-Luftschiffabteilung) was vested in Captain Peter Strasser, who held this appointment till August, 1918, when he perished in an airship that was shot down in flames by British warships. It seems to be established that he was an officer of outstanding ability, whose technical knowledge, energy, and powers of organisation were largely responsible for the efficient state of the service throughout the war. Shortly after the outbreak of hostilities an agreement was reached with the army command, under which one out of every two new ships completed by the Zeppelin company was to be relinquished to the navy, which also secured control over a number of Schütte-Lanz airships. Measures were at once taken to increase the housing facilities. The first large shed, that at Nordholz, near Cuxhaven, had been hurriedly completed in August, 1914, and new sheds were ordered to be built at Tondern, in Schleswig, Haage, in East Friesland, and Seddin, in Pomerania, each of these stations being protected by an adjacent battery of anti-aircraft guns and searchlights. At the same time a chain of meteorological stations was established along the German coastline, from Ostend, Belgium, to Koenigsberg, in East Prussia. From these stations weather reports were transmitted every three hours by wireless or cable to the headquarters at Wilhelmshaven. Special arrangements had to be made for supplying gas to the various airship depôts, as in most cases the local resources were inadequate for the purpose. This widespread organisation absorbed a very large personnel, and it was no easy matter to find the requisite number of specially trained officers and men. Among the various aerial projects conceived during the war was one of sending up from Flanders an ordinary balloon, which was to drift over London and drop a 2,200-pound bomb on the city. This scheme was abandoned after three fruitless attempts had been made.

It was speedily discovered, states Lieutenant von Schiller, that the type of airship in vogue at the beginning of the war, which was of 22,500 cubic metres capacity, was not sufficiently powerful to perform the arduous duties of war, including long-distance raids. The next type was therefore increased to 32,000 cubic metres, which had already been reached in the first Schütte-Lanz to be acquired by the navy. Even this size proved inadequate, however, and early in 1916 the *L-30*, of 55,000 cubic metres, was built. The difficulty of handling such large vessels on the ground, especially in bad weather, was very great, for which reason it looked as though the limit in dimensions had been reached, and for the next two years the 55,000 cubic metre type continued to represent the standard German airship. Besides the Zeppelin, the only other rigid type that proved equal to the strain of war service was the Schütte-Lanz, and even vessels of that type were unsuited to North Sea work owing to their wooden construction. A few non-rigids were built for coast patrol, and a new type, built on the Gross-Basenach system, was evolved, but its performance is not described.

In the autumn of 1916 the naval airship service began to suffer severe losses in the course of its raids on England, where the anti-aircraft batteries and defending aeroplanes had become both numerous and efficient. One of the first vessels to be shot down was the *L-31*—in October, 1916—whose commander, Mathy, had carried out the first attack on the city of London twelve months previously. In spite of these losses, however, Captain Strasser worked unremittingly to overcome the defence, introducing various modifications which enabled the Zeppelins to rise to much greater alti-

tudes when over enemy territory. By the summer of 1917, attacks were being made from heights so great that the personnel had to be artificially supplied with oxygen. Airships scouting at sea were also compelled to fly very high—eventually at 16,400 feet—in order to avoid attack by enemy seaplanes, and, later on, by aeroplanes flown from the decks of British cruisers.

At the end of 1917 a plan was evolved of conveying to the hard-pressed troops in East Africa a supply of ammunition and medicines by a Zeppelin, the feasibility of the enterprise having been demonstrated by an endurance flight of 105 hours made by the *LZ-120*. An airship of the 55,000 cubic metre class, *L-57*, was selected for the voyage and lengthened by 98½ feet to increase her useful load. This vessel, however, came to grief on her trial trip, and eight weeks elapsed before a new ship, *L-59*, could be made ready. Starting from an emergency base at Jamboli, in Bulgaria, she had got as far as the Dachel oasis on the Upper Nile when a wireless message was received from Berlin, ordering her to return, as news had come of the evacuation of East Africa by the German troops. She returned to Jamboli without mishap, after a round voyage lasting ninety-six hours, the total distance covered being 4,375 miles. This was unquestionably the boldest and most remarkable airship flight of the whole war, and one, moreover, that has not as yet been surpassed. On returning to her base, the *L-59* was partially reconstructed, after which she made a raid on Naples. Her next exploit was to have been a bomb attack on the British naval base at Malta, but while *en route* in the Strait of Otranto she was destroyed in mid-air by an explosion, the cause of which was never ascertained.

Particulars of the German Naval Airship Fleet

Zeppelins

Designation	Capacity	Useful load	Motors	Speed	Ballonets	Date of completion	Maximum ceiling
	Cub. metres.	Kilos.	No. and h.p.	Ft. per sec.			Feet
L-1	22,500	8,600	3 of 160	69	18	1912	—
L-2	27,000	11,000	3 of 160	68.9	18	1913	—
L-3 to *8*	22,500	8,700	3 of 180	70	18	1914–15	8,200
L-9	25,000	10,000	3 of 210	72.2	15	1915	9,842
L-10 to *19*	32,000	15,600	4 of 210	82	16	1915	10,500
L-20 to *25*	35,800	17,800	4 of 240	82	18	1915–16	11,480
L-30 to *42*	55,000	30,000	6 of 240	91.9	19	1916	13,123
L-43 to *52*	55,800	39,000	5 of 260	96.5	18	1917	18,044
L-53 to *65*	56,000	40,000	5 of 260	100	14	1917–18	19,684 to 21,324
L-57, *L-59*	68,500	52,000	5 of 260	91.9	16	1917	22,470
L-70	62,200	47,000	7 of 260	105	15	1918	21,980
L-71, *L-72*	62,200	49,000	6 of 260	105	15	1918	22,960
			Schütte-Lanz				
SL-3, *4*	32,400	13,400	4 of 210	78.7	15	1914–15	8,857
SL-6, *8*, *9*	35,000	16,000	4 of 210	85.3	16	1915–16	11,480
SL-12, *14*	38,700	20,000	4 of 240	85.3	17	1916–17	12,138
SL-20, *22*	56,000	35,500	5 of 260	95.15	16	1917–18	14,763

NOTE.—In addition, there were four Parseval airships and one of a special type, *M-4*.

Performances and Losses During the War

Year	No. of airships in service			Scouting trips	Raids	Losses caused by—				Placed out of commission
	Simultaneously		Total during year			Enemy action	Bad weather	Explosion	Total	
	Max.	Min.								
1914.....	4	1	6	59	—	—	—	—	—	1
1915.....	15	5	22	389	30	4	4	2	10	1
1916.....	19	14	31	296	107	8	4	4	16	1
1917.....	19	11	39	281	46	9	5	—	14	9
1918.....	11	7	23	123	17	5	1	6	12	3
	—	—	—	1,148	200	26	14	12	52	15

During 1914 and 1915 the airships *Viktoria Luise* and *Sachsen*, used for training purposes, were employed for short-range scouting duty, but were placed out of commission in 1915.

The total number of airships employed during the war were as follows: 65 Zeppelins, 9 Schütte-Lanz, 3 Parsevals, 1-M type. Of this number, 72 were available for scouting duty and raids, the others being detailed for training purposes. Each of these 72 ships made an average of 16 scouting trips and 3 raids. In the Baltic, 24 airships made 220 scouting trips and 41 raids. In the North Sea, 70 ships made 928 scouting trips and 159 raids.

Of the airships lost, 19 were destroyed with all hands; the crews of 6 were taken prisoner, and the crews of 3 were interned in neutral countries. Twenty-four airships were destroyed without loss of personnel.

From beginning to end, the German naval airship fleet had sixteen stations with shed accommodation under its control, including the emergency station at Jamboli in Bulgaria. The principal station was at Nordholz, near Cuxhaven, where eventually there was accommodation for six ships of the largest type and two smaller vessels.

In addition to casualties from enemy action, heavy losses were suffered through bad weather and accident. There had already been several cases of individual ships having been destroyed in their sheds by fire, but in January, 1918, five of the very latest vessels were simultaneously destroyed by an explosion at the Ahlhorn depôt. By 1918 it was recognised that the war value of the Zeppelin had sensibly declined. Aeroplanes, in conjunction with "an excellently organised artillery," had rendered airship raids on England too hazardous to be attempted, except on rare occasions when the weather was particularly auspicious. At the same time airship reconnaissance over the North Sea had become exceedingly dangerous by reason of the speedy and fast-climbing aeroplanes carried on British warships. These machines not only brought down a number of scouting Zeppelins, but even attacked the latter in their own sheds, two being destroyed in this way at Tondern in July, 1918. In the vain hope of circumventing British gunners and aviators, Captain Strasser designed a new type, beginning with *L-70*, which was fitted with seven motors and had a maximum ceiling of 23,000 feet. On August 6, 1918, this giant craft set out to raid England, those on board including Captain Strasser himself, who had insisted on making the expedition in spite of the remonstrances of his brother officers. While over the North Sea in bright moonlight the *L-70* was sighted by British warships and promptly shot down in flames with the loss of all hands, the atmospheric conditions having been such that she could not maintain her maximum altitude. The death of Captain Strasser made profound impression in Germany, which was intensified when, five days later, the *L-53*, commanded by Captain Prolss, another of the ablest officers in the service, was destroyed in the North Sea, this time by an aeroplane. These successive disasters appear to have caused a reaction against the Zeppelin, for all further raids and reconnaissances were forbidden, pending the completion of a new type, which it was hoped would prove less vulnerable. This vessel had a capacity of 62,000 cubic metres,

but before she was ready the German cause collapsed, and airship development was forthwith arrested.

The principal war duties assigned to the German naval airships were, according to Lieutenant von Schiller, as follows:

(1) Daylight reconnaissance of a general nature in the Baltic, North Sea, Skagerrack, and Cattegat, and often as far as the British coast; in the summer months, night scouting.
(2) Scouting in advance when sorties by the fleet or special naval enterprises were contemplated.
(3) Screening the battle fleet at sea and giving escort to incoming or outgoing auxiliary cruisers.
(4) Protecting the mine-sweeping flotillas and occasionally searching for mines themselves.
(5) Making attacks against England and Russia.

In reviewing the Zeppelin raids on England, Lieutenant von Schiller argues that they were justified not only by the material and moral damage inflicted on the enemy, but also by the fact that the Zeppelin menace compelled England to retain at home a large number of guns, aeroplanes, and men whose weight would otherwise have been felt on the western front. When the revolution occurred the German navy had only seven effective airships left, and these were intentionally destroyed in their sheds on July 19, 1919, the day on which the high sea fleet scuttled in Scapa Flow.—*The Engineer,* 12 May, 1922.

GERMANY'S ONLY SCHOOL SHIP.—Under the terms of the Versailles Peace Treaty all of the training ships belonging to the German merchant marine had to be surrendered to the Allies with the exception of the *Grosherzogin Elisabeth,* a steel sailing vessel of 1,260 tons, built in 1901, and belonging to the German School Ship Society. During the last twenty years 2,542 officers for the German merchant marine have been graduated from this ship.

The vessel has accommodation for 167 cadets and made a cruise last fall to the West Indies. On her voyages she carries cargo in order to reduce expenses and to give those on board an opportunity of learning how to load and discharge freight.—*Nautical Gazette,* 13 May, 1922.

GREAT BRITAIN

THE NEW BATTLESHIPS.—Sir Percy Scott appears to have been misinformed on the subject of battleship construction. In a letter to the *Times* he stated that he had heard privately that the date of beginning the two new battleships had not been settled and that this meant that they were not to be built at all. On the contrary, we learn that the plans of the ships are in such a forward condition that it is fully expected the contractors will be asked to tender for their construction early in June. It should be noticed also that in the detailed naval estimates just issued the total expenditure on these two ships to March 31 of next year, excluding their armament and ordnance stores, is rather over a quarter of a million sterling. This indicates, as the ships are to be smaller than the four originally ordered and will probably not exceed 35,000 tons displacement each, that a fair amount of material will be worked up before the end of the financial year. Doubtless the same firms which competed for the four ships will compete for these two, but whether, as in that case, the contracts go to the Clyde and the Tyne must remain uncertain for the present.—*Army, Navy, and Air Force Gazette,* 30 May. 1922.

NEW BATTLESHIP PLANS.—It is doubtful whether our constructors have ever been faced with a task so formidable as the design of these two new vessels. The pre-war capital ship was already approaching the 30,000-ton limit, and even then it was no easy matter to embody the speed, armament, and protection which naval opinion insisted upon. Now, however, there is a demand for much heavier protection above and below the waterline, together with a stronger armament, and the percentage of weight allotted to these two factors has increased enormously. What Sir E. T. d'Eyncourt and his staff are now called upon to do is to design a ship able to resist 16-inch projectiles, including those which, having been discharged at very long range, are liable to fall at a steep angle; so well protected beneath the waterline as to be capable of withstanding several blows from torpedoes or bombs of the largest size, and with decks sufficiently strong to defeat attack by heavy charges of high explosives dropped from the air; to mount an armament not inferior in weight of numbers to that of any foreign capital ship now afloat; to possess a speed well up to the average of foreign battleships; and withal to displace, when completed, no more than 35,000 tons.

The problem at first sight seems almost impossible of solution, but our constructors have already given so many instances of their skill that we do not doubt their ability to produce a satisfactory design in this case also. Obviously, however, the drafting of plans for ships of so novel a character must be a lengthy business, occupying far more time than would be needed were it merely a question of modifying some type already in existence. Even if the designers got to work immediately after the Washington decisions became known, it is doubtful whether the first complete drawings could be finished in less than six months, and their preparation may, in fact, take a good deal longer than that.

Owing to repeated modifications, it is said, the plans of the four super-*Hoods* took nearly eighteen months to finish, and the design of those ships can scarcely have presented so much difficulty as that of the two "Conference" battleships. If, therefore, their keels are laid early next year, the admiralty constructors will have performed some very smart work. In any case, the delay will not be so great as to involve that "irrevocable loss of time and building facilities which might make it impossible to maintain our sea security if it should be threatened," to quote the prime minister's words last July, when he was explaining the need for the battle-cruiser programme that was subsequently dropped as a result of the Limitation Treaty.—*Naval and Military Record,* 17 May, 1922.

FISHERY PROTECTION.—The Bolshevists, through their so-called trade delegation, are understood to be complaining because the British Government have despatched a warship into northern Russian waters for the protection of the British fishermen and their vessels. The Soviet Government have threatened, it is reported, to send armed vessels to enforce the rights which they claim to assert over a twelve-mile limit. The situation has a disagreeable aspect, for in the first place the British navy is represented by the little *Harebell,* a sloop carrying two 4-inch and two 12-pounders as her armament; while if the Russians carry out their threat they have the power to put a much stronger force in those seas. Moreover, it is believed that their vessels are commanded by German naval officers, some of whom may have been submarine captains in the late war. As to the legality of the Bolshevists' decree of May 24, 1921, prohibiting foreign fishing within twelve miles of their coast, our Government has already protested against it. So far, however, the Russians have ignored the British protests and are apparently prepared to support their breach of international law by further offensive action. Doubtless the German officers in Russian employ

will be quite ready to put fire to the fuel, and in the circumstances it is somewhat surprising that a stronger force was not sent to the scene of possible action.—*Army, Navy, and Air Force Gazette,* 19 April, 1922.

COM. BURNEY'S AIR SCHEME.—The air ministry last week made a tentative suggestion to the treasury to ascertain whether any support can be given by the state to Commander Burney's scheme for using British airships. The treasury is unable to consider any of the proposals if they involve lending large sums of money. Consequently government aid to Commander Burney and the important syndicate for which he speaks now appears to be impossible, and the air ministry does not expect that anything will come of the scheme.—*Naval and Military Record,* 16 May, 1922.

WARSHIPS' CABLES.—The attention of officers in command of fleets and squadrons is called by the admiralty in a lengthy order issued on Friday to the immense strain brought on cables anchoring heavy ships with much way on. The parting of chain cable in H. M. ships is mainly due to the gradual weakening of the cables, consequent on the excessive strain to which they are subjected when mooring, and more care in the manipulation of the cables would increase their "life" and reduce the possibilities of accident through parting.

The lengths of cable which part are generally those amongst the first six shackles, which include the shackles used for hauling round the bows. Mooring ship, however carefully carried out, is liable to strain the cable, and heavy strains are from time to time brought on the cables in the desire to avoid veering unnecessarily on the first anchor, and also in the use of slack shackles for hauling round the bows. These strains gradually distort and weaken the links, but so long as the cable does not part they are ignored. When eventually parting takes place without any immediate cause assignable, the accident is attributed to defective material or unsuitable size of cable, but in such circumstances it is improbable that an increase in the size of cable would prevent the best material from parting.

The efficiency of ships' cables is of such supreme importance that rapidity in mooring should give place to a method in which the strain on the cables is reduced to a minimum.—*Naval and Military Record,* 10 May, 1922.

VALUE OF SMALL HIGH-SPEED TORPEDO VESSELS.—Whatever may be the ultimate decision as to the employment of light craft in naval warfare of the future, there can be little doubt that the class of small high-speed torpedo vessels propelled by internal-combustion engines, and known as coastal motor boats (or more familiarly as C. M. B.s), will play an even more important part than they did in the last war, says *Engineering.*

The form of hull employed in these vessels, which are of the skimming type, was developed by model experiments carried out by Sir John I. Thornycroft over a period of ten years or so prior to the war, the object being to produce a form having a very low resistance combined with good seagoing qualities. Tank experiments alone were not sufficient to determine the best proportions and form, and actual boats which were built and tried at sea by Sir John's son, Mr. Tom Thornycroft, played an important part in the developments.

The boats of this class constructed before the war, however, were only employed for racing and experimental purposes, carrying not more than two or three men, and just sufficient fuel for the completion of a race. Considerable modification was therefore necessary to render them suitable for carrying one or two torpedoes, each weighing about 15 cwt., as well as the fuel supply necessary to give a useful radius of action, the crew of

three or four men required to work the boat under war conditions, and the discharging gear for the torpedoes.

At the period of the war when Admiral Sir Henry Jackson was first sea lord, it was decided that motor torpedo boats should be built, and Messrs. John I. Thornycroft and Co., Ltd., were given instructions to build as quickly as possible twelve experimental boats of the special form of hull to which reference has been made. Further experiments were carried out, and the designs prepared for 40-feet and 55-feet boats, of which a large number was eventually built by Messrs. Thornycroft themselves and several other firms acting as their sub-contractors from 1915 to 1918.

A full account of the exploits of these vessels would form extremely interesting reading, but the utmost secrecy was naturally observed regarding their construction and employment during the war, so that, for a considerable period the general public was quite unaware of their existence. Very little has been published on the subject since the conclusion of hostilities, but it is now known that the vessels were first employed in the winter of 1916-17 at Dunkirk, from which base they were frequently in action with German patrol boats and destroyers. For work in the North Sea they were based at Harwich, and, armed with depth charges, as well as with torpedoes, were effectively employed in countering the submarine menace.

They were also used for laying mines in positions which were inaccessible to ordinary mine-laying craft. More striking, however, was their work in connection with the blocking actions at Zeebrugge and Ostend in 1918, and, after the armistice, in the attack on Kronstadt. It will be remembered that the Russian cruiser *Oleg* was first torpedoed by a coastal motor boat outside Kronstadt Harbor and that afterwards several Russian vessels were destroyed in the harbor itself in an action that was unique in naval history.

That the possibilities of coastal motor boats are now being considered by other naval powers may be gathered from the fact that Messrs. Thornycroft have received orders for them from the French, American, Japanese, and other Governments.—*Engineering.*

SURPLUS NAVAL OFFICER.—In a fleet order, issued on Friday, May 12, the following special retirement terms are those offered to executive officers. The approximate number of surplus officers is as follows:

	Executive Officers	Engineer Officers	Accountant Officers	Royal Marines
Captains	119	—	—	5 Lieut. Cols., R. M.
Commanders	200	84	26	14 Majors, R.M.
Lieut. Commanders	—	—	18	A few Captains and
Lieuts., ex-Cadets	407 (under 4 years)	—	31	Lieuts., R.M.
Lieuts., ex-Mates	139	—	—	—
Lieuts., ex-Warrant Officers (Special)	44	23	—	28 Captains and Lieuts., R.M. (promoted from ranks)
Sub-Lieuts	46	—	—	—
Commissioned and Warrant Officers	474	138	26	13
Total	1,429	245	101	60

Grand Total—1,835

Terms Open for Six Months

The special terms of retirement will be open for a maximum period of six months from May 12, 1922.

Captains, R. N.

Captains of six years' seniority and above on August 12, 1922, who, on the date of retirement, have the qualifying service for promotion laid down in Article 263, King's Regulations and Admiralty Instructions, to receive retired pay at the rate of £800 per annum for twenty-one years' service counting towards retired pay, with an addition or reduction of £15 per annum (limited to five years) for each complete year in excess of or short of the standard on August 12, 1922. Captains of three years' seniority and above on August 12, 1922, including captains of six years' seniority and above, who have not, at the date of retirement, the qualifying service for promotion, to receive retired pay at the rate of £700 per annum for eighteen years' service counting for retired pay, with an addition or reduction of £15 per annum (limited to five years) for each complete year in excess of or short of the standard on August 12, 1922. Officers retired with the foregoing special rates of retired pay to be eligible to rise by seniority to the rank of rear admiral on the retired list, provided that, at the date of retirement, they have had three years' service as captain in command of a ship of war at sea. Captains under three years' seniority on August 12, 1922, to receive the rate of retired pay for which they are eligible under the regulations if they retired on that date, with an addition of £100 per annum to retired pay.

The alternative for officers selected for retirement will be: To be placed on half-pay (if not already on half-pay) and to be retired for non-service, on the expiration of two years from their last date of "service," or three years from date of promotion to captain, if later, with the rate of retired pay laid down under existing regulations. Officers choosing this alternative will be promoted to the rank of rear admiral on the retired list, only if before retirement they had completed the full qualifying service for promotion laid down in Article 263, King's Regulations and Admiralty Instructions.

Commanders, R. N.

The following special terms are offered to commanders who by age and service have qualified or will have qualified by August 12, 1922, for the maximum rate of retired pay of their rank, and commanders of seniorities 1915 to 1919 inclusive. Commanders who have qualified or will have qualified under the ordinary regulations for the maximum rate of retired pay of their rank on August 12, 1922, will be eligible to receive, in addition to this rate of retired pay, a gratuity of £250 for each complete year by which they are short of fifty years of age on the day previous to the day of commencing retired pay, with an addition of £62 10s. for each complete three months of an uncompleted year, subject to a maximum gratuity of £750 not being exceeded in each case. Time for these gratuities will be reckoned as laid down in K. R., 6 of October, 1921. Commanders of seniorities 1915 to 1919 inclusive will be given the rate of retired pay to which they would be entitled under existing regulations (*vide* p. 2264A of the *Quarterly Navy List*) if they retired on August 12, 1922, together with an addition of £100 per annum, subject to a total maximum of £600 per annum not being exceeded. Gratuities will not be paid in addition.

The alternative for officers selected for retirement will be: To be placed on unemployed or half-pay (if not already on unemployed or half-pay) in accordance with the ordinary regulations, and to be retired for

non-service on the expiration of two years from their last date of "service," with the rate of retired pay laid down in the regulations.

Lieutenants, ex-Cadets

The following special terms shall be open to lieutenants ex-cadet of seniorities 1918 and later:

Seniority on August 12, 1922	Retired pay per annum
Less than 1 year	£ 82 10
1 year, but less than 2 years	£ 90 0
2 years, but less than 3 years	£ 97 10
3 years, but less than 4 years	£105 0
4 years, but less than 5 years	£112 10

(Plus a sum of £350, with a gratuity in addition reckoned as follows from the date of first joining a seagoing ship to August 12: For each of the first three complete years, £50; for each complete year subsequently, £100; for each complete three months of an uncompleted year, £12 10s. or £25, according to whether the period of service is under or over three years. Time for these gratuities will be reckoned as laid down in K. R. 6, of October, 1921 (Explanation of Terms). Acting lieutenants to be eligible for these rates on the basis of their acting seniority.

The alternative for officers selected for retirement will be: To be placed on unemployed or half-pay (if not already on unemployed or half-pay) and receiving unemployed pay for the first six months from original date of ceasing employment or full pay leave, at the rate of the full pay of their rank and seniority (without allowances); for the next six months 17s. a day, and for a further period of two years, half-pay at half the full pay of their rank and seniority. As soon as three years have elapsed since their last "service" they will be placed on the retired list for non-service with retired pay at the following rates per annum:

Less than 1 year's service as lieutenant	£ 75 0
1 year, but less than 2 years as lieutenant	£ 82 10
2 years, but less than 3 years as lieutenant	£ 90 0
3 years, but less than 4 years as lieutenant	£ 97 10
4 years, but less than 5 years as lieutenant	£105 0
5 years, but less than 6 years as lieutenant	£112 10

For the purpose of retired pay, service on full pay counts in full, but service on unemployed pay (either at the full pay rate or the intermediate rate), and service on half-pay counts as one-third.

Sub-Lieutenants, Midshipmen, and Cadets

The sub-lieutenants', midshipmen's, and naval cadets' lists, taken as a whole, are not materially overborne, provided that the proper proportion of sub-lieutenants and midshipmen volunteer for engineering, in which branch the prospects of junior officers are at the present time much brighter than in the executive branch. A certain number of sub-lieutenants, other than those who have volunteered for (E), will be allowed to retire with a gratuity of £500. Should the number of sub-lieutenants retiring voluntarily be insufficient, it may be necessary to select some officers for retirement. No reductions are contemplated in the case of midshipmen and cadets other than those already approved for the term passing out of Dartmouth in August, 1922.

GENERAL

The admiralty desire to state emphatically that the fact that an officer is selected for retirement under this scheme in no way constitutes any reflection upon his character, conduct, or ability during his naval service. All officers retired under these schemes are liable for service, if required, in the event of war or emergency. The admiralty reserve the right to close the scheme at any time without previous notice, either generally or in respect of any particular rank or seniority, as soon as the necessary reductions have been effected. They also reserve the right of withholding permission from any officer to retire under the scheme, and they may direct that any officer, during the time the scheme is open, is to be retired under any other regulations which are applicable to his case. (E) officers and officers specializing in (E) are excluded from this scheme. Twenty per cent of all rates of retired pay granted under these schemes is to be considered as due to the high cost of living, and as these rates are based upon the ordinary rates fixed in 1919 with regard to the cost of living at that date they will similarly and to the same extent be subject to revision either upwards or downwards on July 1, 1924, and subsequently.—*Army, Navy, and Air Force Gazette,* 20 May, 1922.

THE AMERICAN NAVAL PERSONNEL.—It is not entirely clear even now to what numbers the personnel of the United States navy will be limited. The bill as originally placed before the House of Representatives provided for 67,000 enlisted men, whereas the department of the navy considered that at least 96,000 were necessary. An amendment to this effect was proposed by Mr. Rogers. A further amendment, increasing the number in the bill to 86,000, 80,000 enlisted men and 6,000 apprentices, was proposed by Mr. McArthur, the representative of Oregon. This amendment was accepted by a record vote of 221 against 148. In the course of the discussion it was stated that the personnel of the British navy would be by March of next year 117,758, after the proposed reductions. There is an error here, for by March of next year the personnel of the British navy is to be reduced to 97,000, as is shown in the estimates and by Lord Lee's memorandum. If also all the naval personnel of the United States is counted in, the total works out at considerably more than 86,000. Not until we have the exact figures showing, in addition to the number of officers and enlisted men, the other groups administered by the navy department, can we draw any comparison of value with the numbers of our own personnel. Meantime attempts are being made in America to demonstrate that the British and Japanese navies are to be supplied proportionately with thirty per cent more men than is allowed to the United States fleet. The fact is that while we are cutting down our lists of officers the Americans are aiming to maintain their commissioned list, as Mr. Denby contended must be the case, especially as regards the executive officers. "If I have to cut the commissioned list," he said, "the line or civil officer must go, for they can be replaced more easily in war time." It would be of advantage if the facts about the personnel of the three navies were explained by question and answer in Parliament.—*Army, Navy, and Air Force Gazette,* 13 May, 1922.

NO BRITISH DRY-DOCK FOR THE "MAJESTIC."—Negotiations for the purchase of a large dry-dock from the Port of Hamburg having broken down, Viscount Devonport at a luncheon on the White Star liner *Majestic* at Southampton stated that there was no single dry-dock in the United Kingdom where the *Majestic* could be docked. He regretted that most exceedingly, because the Port of London authority had recently opened a dock which, had it not been for adverse circumstances, would certainly

have been big enough for any ship in the world. Thanks to the enterprise of the London and South Western railway, however, all difficulties have been overcome. It seems that the railway undertaking, with that characteristic spirit which has been responsible for raising Southampton to the position of the premier British port for the largest and fastest mail steamer, has entered into provisional agreement whereby an adequate floating dry-dock will be provided within the next twelve months. This is enterprise indeed, and shows that the southern port will leave no stone unturned to maintain the laurels it has so deservedly won.—*Nautical Gazette*, 27 May, 1922.

JAPAN

JAPAN'S SHIPBUILDING POLICY.—Further particulars of the Japanese naval shipbuilding programme which have recently come to hand confirm the statement previously made in these columns to the effect that the Limitation Treaty negotiated at Washington has not resulted in that complete cessation of warship building which the authors of the conference were desirous of bringing about. Japan, it is true, has cancelled the whole of her uncompleted capital ships and thus fulfilled her treaty obligations to the letter, but at the same time she has found it necessary in the interests of national defence, and perhaps still more for economic reasons, to put in hand a considerable number of new vessels representing types which are outside the scope of the treaty. A Japanese correspondent who is in a position to speak with authority assures me that had the Government attempted to fulfill not merely the letter of the Disarmament Treaty, but its spirit also, a domestic crisis of the utmost gravity would have been precipitated thereby.

"It is not too much to say," he writes, "that the annulment of all outstanding naval contracts would have swamped us in a sea of industrial troubles that might have culminated in revolution. The Government was faced on the one hand with the claims of those many thousands of people, including some of the most influential in the country, whose capital is locked up in shipbuilding enterprises which are at this moment almost entirely dependent on naval orders for their subsistence, and on the other hand by the demand of 100,000 work people employed in shipbuilding, engineering, and marine equipment trades that no action likely to imperil their livelihood should be taken. It is most necessary that the dilemma in which our Government was placed should be understood abroad, since otherwise its action in continuing to order warships of the smaller types may be misconstrued. It is a mistake to suppose that the military party is urging the Government to expand its naval armaments regardless of the Limitation Treaty. The truth is that the militarists are more anxious to improve the fighting equipment of the army, and they think that the money saved on battleships should be spent for this purpose. If a considerable number of orders for cruisers, submarines, etc., have been placed during the past few months, it has simply been to save the shipyards from closing their doors, and thus throwing many thousands of workmen out of employment at a time when Bolshevist agitators are trying hard to stampede Japanese labor in the direction of revolution.

My correspondent adds that in all probability the ships recently ordered will be constructed very slowly, with the object of spreading the work over as long a period as possible. Although the actual dates on which the contracts were awarded are uncertain, it is understood that at least ten light cruisers have been contracted for within the past six months, all of which, it is important to note, have been authorized under the 1920 programme, though in the normal course of events their construction would

not have begun so soon. There are at present on the stocks or about to be laid down the following ten light cruisers: *Minase, Otonase, Ayase, Jintsu, Sendai, Naka, Kako, Abukuma, Yubari, Kinu,* while three similar vessels, *Yura, Natori,* and *Isudzu,* are completing afloat. Authentic particulars of these ships are not yet available, but there is reason to believe that they average 6,000 tons in displacement, are designed for a speed of 33 knots, and carry seven 5.5-inch or 6-inch guns. Destroyers to the number of at least 30 are building or shortly to be laid down, the majority being very large and fast boats, the remainder with displacements of less than 1,000 tons. Strict reticence is maintained by the Japanese authorities regarding the number and type of submarines actually building, but it seems certain that not less than 30 of these craft are now in hand and that orders for a further ten have been placed. Unless, however, recourse is had to foreign manufacturers, the execution of the submarine programme will probably be a very slow business, for it is doubtful whether Japanese industry is in a position to build a large number of the powerful motors required for the latest type of Japanese ocean-going submersible, which is a vessel of large dimensions and high speed.

It will be interesting to observe the effect of this post-conference shipbuilding activity in Japan on the naval policy of the United States. By the time that the ten new American light cruisers are completed Japan will have at least twice that number of similar ships in commission, besides a submarine flotilla which in numbers and fighting power will compare very favorably with the American establishment. The general board of the United States navy is known to be strongly advocating an immediate extension of the light-cruiser programme, but thus far no new construction has been authorized.—*Naval and Military Record.*

NOTES FROM JAPAN.—Upon his return from Washington, where he had acted as chief Japanese delegate to the conference, Admiral Baron Kato, minister of the navy, gave the Imperial Diet some further details of the negotiations which had preceded the signing of the naval treaty, and dealt with certain criticisms raised by the various members. With regard to the question of Pacific fortifications, one member argued that if these were to be limited at all such limitation should cover the whole of the Pacific. Hawaii, however, being a great distance from the American continent, was excluded from the scope of the agreement, while the Bonins and Amami Oshima, which no one had any doubt of being part of Japan proper, were included. This was criticized by the speaker as a one-sided arrangement. In reply Admiral Kato said that he took a different view of the fortification question. The Philippines had undoubtedly been a menace to Japan, who was therefore particularly desirous that the fortification of those islands should be limited, seeing that they were the only point where a powerful naval base, such as would constitute a serious danger to Japan, could be created. As for the Bonins and the Amami Oshima, they could never be made into powerful naval bases, even if forts were built there. As Japan was so anxious that the fortification of the Philippines should not be extended, he considered it would have been very disadvantageous if his insistence of the inclusion of Hawaii had resulted in the defeat of the entire proposal, and he had therefore deemed it the wisest policy to make concessions on the question of Hawaii.

Interpellated as to the intentions of the Government with regard to the future programme of cruisers, destroyers, and submarines, Admiral Kato declared that there was no intention of enlarging this programme, though alterations might be made in the size and type of the vessels concerned, a remark which applied to submarines as well as to surface craft.

A lieutenant of the Japanese navy was court-martialed at Yokosuka last month on a charge of attempted fraud, and sentenced to one year's penal servitude and dismissal from the service. He had endeavored some time ago to sell various "naval secrets" to the American Embassy, which at once communicated with the Japanese police. Investigation showed that the documents which he had offered to Captain Watson, the naval attaché to the Embassy, contained no information that was really confidential and had probably been "faked" by him. This is believed to be the first case in which an officer of the Japanese navy has been convicted of a crime involving treason, though even in this instance it is clear that the culprit had no real intention of divulging official secrets. The action of the American embassy in so promptly notifying the Japanese authorities of the plot is said to have made an excellent impression in Tokio.—*Naval and Military Record,* 13 May, 1922.

JAPANESE SEAMEN'S WAGES.—According to testimony given at the hearings of the pending ship subsidy bill Japanese seamen's wages in the trans-Pacific trade are as follows: There are four grades of able seamen with wages ranging from 49 to 58 yen, two grades of firemen receiving 58 to 59 yen and two grades of coal passers paid at the rate of 50 and 52 yen. A yen is worth about fifty cents.—*Nautical Gazette,* 27 May, 1922.

OSAKA SHOSEN KAISHA.—The annual report of the Osaka Shosen Kaisha company shows that the company's gross earnings in 1921 totaled 59,335,075 yen as against 89,716,444 yen in 1920. Last year's receipts were derived from the following sources of income:

	Per cent
Freights	72.8
Passenger Fares	16.3
Miscellaneous Receipts	7.3
Subsidies	3.6

Net earnings last year were only 2,029,742 yen as compared with 11,052,890 yen in 1920. At the close of the year the company's fleet consisted of 133 vessels of 414,149 gross tons valued at 68,728,912 yen or at the rate of 165.95 yen per ton. The amount spent on repairs last year was 3,231,992 yen or 4.7 per cent of the book value of the steamer fleet. The company is conducting 48 regular services and last year carried 1,731,790 passengers.

While the results for last year were disappointing, the directors report that the net earnings in the second half of last year were 1,762,379 yen greater than in the first half. The better showing was due to a reduction in working expenses and not to an improvement in business.—*Nautical Gazette,* 5 June, 1922.

UNITED STATES

NAVY DEPARTMENT, BUREAU OF CONSTRUCTION AND REPAIR, WASHINGTON, D. C.

May 10, 1922

VESSELS UNDER CONSTRUCTION, UNITED STATES NAVY—Progress as of April 30, 1922

Type Number and Name	Contractor	Per cent of Completion				Contract date of Completion	Probable date of Completion
		May 1, 1922 Total	May 1, 1922 On Ship	April 1, 1922 Total	April 1, 1922 On Ship		
BATTLESHIPS (BB)							
45 *Colorado*	New York S. B. Cpn.	91.7	91.2	90.7	90.		Indefinite
47 *Washington*	New York S. B. Cpn.	75.9	70.3	75.9	70.3		Indefinite
48 *West Virginia*	Newport News S. B. & D. D. Co.	80.	78.3	78.	76.		Indefinite
49 *South Dakota*	New York Navy Yd.	38.5	31.6	38.5	31.6		Indefinite
50 *Indiana*	New York Navy Yd.	34.7	27.2	34.7	27.2		Indefinite
51 *Montana*	Mare Island Navy Yd.	27.6	19.	27.6	19.		Indefinite
52 *North Carolina*	Norfolk Navy Yd.	36.7	27.1	36.7	27.1		Indefinite
53 *Iowa*	Newport News S. B. & D. D. Co.	31.8	27.4	31.8	27.4	7/12/23	Indefinite
54 *Massachusetts*	Beth. S. B. Cpn. (Fore River)	11.	4.3	11.	4.3	7/12/23	Indefinite
BATTLE CRUISERS (CC)							
1 *Lexington*	Beth. S. B. Cpn. (Fore River)	33.8	24.2	33.8	24.2		Indefinite
2 *Constellation*	Newport News S. B. & D. D. Co.	22.7	19.5	22.7	19.5		Indefinite
3 *Saratoga*	New York S. B. Cpn.	35.4	28.	35.4	28.		Indefinite
4 *Ranger*	Newport News S. B. & D. D. Co.	4.	1.5	4.	1.5		Indefinite
5 *Constitution*	Philadelphia Navy Yd.	13.4	8.4	13.4	8.4		Indefinite
6 *United States*	Philadelphia Navy Yd.	12.1	7.1	12.1	7.1		Indefinite
SCOUT CRUISERS (LIGHT CRUISERS) (CL)							
4 *Omaha*	Todd D. D. & Const. Cpn.	99.2	94.8	99.2	94.8	8/1/21	Indefinite
5 *Milwaukee*	Todd D. D. & Const. Cpn.	95.	90.	94.9	87.9	12/1/21	Indefinite
6 *Cincinnati*	Todd D. D. & Const. Cpn.	88.2	82.5	88.2	82.	7/1/22	Indefinite
7 *Raleigh*	Beth. S. B. Cpn. (Fore River)	65.9	49.1	64.9	47.6	8/1/21	Indefinite
8 *Detroit*	Beth. S. B. Cpn. (Fore River)	84.7	74.2	82.8	70.8	11/1/21	Indefinite
9 *Richmond*	Wm. Cramp & Sons Co.	90.7	83.5	89.	82.		9/15/22
10 *Concord*	Wm. Cramp & Sons Co.	85.5	78.	85.	78.		12/1/22
11 *Trenton*	Wm. Cramp & Sons Co.	59.	47.	59.	47.	10/1/21	6/1/23
12 *Marblehead*	Wm. Cramp & Sons Co.	47.	33.	47.	33.	1/1/22	10/1/23
13 *Memphis*	Wm. Cramp & Sons Co.	40.	26.	40.	26.	4/1/22	8/1/23
AUXILIARIES							
Repair Ship No. 1, *Medusa* (AR1)	Puget Sd. Navy Yd.	80.8	71.3	79.3	70.8		Indefinite
Dest. Tender No. 3, *Dobbin* (AD3)	Phila. Navy Yd.	71.1	70.8	69.9	69.6		Indefinite
Dest. Tender No. 4, *Whitney* (AD4)	Boston Navy Yd.	52.8	46.5	51.8	45.1		Indefinite
Sub. Tender No. 3, *Holland* (AS3)	Puget Sd. Navy Yd.	21.5	5.5	21.5	5.5		Indefinite
PATROL VESSELS							
Gunboat No. 22, *Tulsa* (PG22)	Charleston Navy Yd.	73.3	62.5	72.7	61.3		Indefinite
DESTROYERS							
*339 *Trever*	Mare Island Navy Yd.	99.8	99.8	99.8	99.8		
340 *Perry*	Mare Island Navy Yd.	98.	98.	95.2	95.2		6/5/22
341 *Decatur*	Mare Island Navy Yd.	88.1	88.1	86.1	86.		7/5/22

Destroyers authorized but not under construction or contract.
(12) Nos. 348 to 359 inclusive.
*Ready for commissioning.

There are three fleet submarines and thirty-eight submarines under construction.

There are six fleet submarines and one submarine authorized but not under construction or contract.

SUBMARINE "S-51" COMPLETES ITS TEST.—The official report to the navy department of the successful completion on Long Island Sound of a 52-hour continuous running test of the submarine *S-51* adds a second modern submersible of this type to the American submarine flotilla. It is one of four of this class under construction for the navy by the Lake Torpedo Company, of Bridgeport, Conn., all of which will soon be commissioned in active service. The *S-51* is 248 feet long.

The *S-51* is a double hull navy-designed boat with many new features that are not found in the other S-class boats. The plan on which she was built contains the most meritorious and effective features of German U-boat construction. One of the most notable new features is the method of opening valves to submerging tanks which makes possible quick drives by the boat. During the trials it was found possible to drop it under water in less than a minute.

Submarines of this type are equipped with four 21-inch torpedo tubes in the bow and one in the aft. They carry a four-inch gun in "wet mount" on the forward deck and afford greater comfort to the crew than previous types. The arrangement of the submerging valves controls lead to a central pneumatic manifold, where the turn of a single lever opens all Kingston valves simultaneously, permitting between 300 and 400 tons of water to flow into the diving tanks in less than 60 seconds.

During the builder's trials of one of these boats the ship was driven at full speed of fifteen knots towards the observing tug until a whistle blast signalled for a crash dive. The submarine was foaming through the water with both of her thousand horsepower oil engines drawing at full power and was riding high in the water. She was steering to pass close along side of the tug.

When the signal was given for the dive the white vapor of the exhaust blast pouring out of either side astern the submarine ceased abruptly. She was switched to her electric motors for submergence and still came on at unchecked speed about three times her length astern the tug. But those on the tug could see that she was sinking swiftly into the water. The big craft was clear under except for her conning tower as she reached the tug's stern. At that point her diving rudders swung her nose down and in anther fifty feet only the slim, rod-like length of the main periscope appeared on the surface.

When the periscope reached a point opposite the pilot house the commander of the submarine ordered rudders up and the big craft "porpoised" to the surface to show a brief glimpse of her super-structure, deck and finally her tilted stern, then vanished completely from sight in an eight-degree "crash" that carried her at full speed to a depth of ninety feet, where she flattened out like a gliding airplane and swung off on a long curve. The whole operation had taken less than sixty seconds and the boat was so perfectly handled and responded so perfectly to her controls that she passed the tug less than her own width. Fifteen minutes later she slid into sight again a half mile away and lay waiting for her observers.—*Army and Navy Journal*, 3 June, 1922.

EXAMINATIONS FOR PROMOTION IN THE NAVY.—As we have previously announced, the bureau of navigation has decided that all those ensigns of the Naval Academy class of 1919 (who were graduated June 6, 1919), will be examined on their stations on June 12, excepting those on the Asiatic station, who will be examined on July 10. These examinations will

start simultaneously under instructions which have been issued by the bureau this week. Those line officers who were recently commissioned in the permanent regular navy from lower grades will, as we have already stated, be given more time in which to prepare. They have been due for promotion in grade for some time, but their examinations have been delayed again, partly due to the considerable number who are detailed to duty in connection with the decommissioning of the destroyers. Orders are now being issued for their examinations on or after August 1, and examining boards on the stations will, as in the case of the Naval Academy ensigns, start the examinations at the same time, but not before August 1.

Line officers whose promotion is dependent upon the distribution of the officers in grade will not be examined until later. A selection board will probably be convened at the navy department at the end of June, at which time it will be practicable to make a redistribution based upon the increase to the line from the graduating class of the Naval Academy. The personnel of the selection board has not yet been decided upon. The names of all officers in the grades of captain, commander and lieutenant commander who, on November 30, 1922, will have completed four years' service in their respective ranks (including service under temporary appointments), will be submitted for the consideration of the selection board, and all officers who are eligible are invited by the bureau to study paragraphs 4 and 5 of article 1655, Navy Regulations, which permit those officers to forward statements for the board inviting attention to any matters of record pertinent to their advancement. These statements should be forwarded to the bureau of navigation at an early date. Medical officers are instructed to submit, on or about June 20, the data required under General Order 385 relating to the eligible officers. Officers selected by the board will be examined later, whenever their services can be spared. Line officers who are due for promotion to the grades of lieutenant and lieutenant commander will be ordered to appear before supervisory boards as soon as the redistribution is made. The bureau expects that all these examinations will be completed during July and August.

Selection boards will also be convened at about the same time for the chaplain corps, the civil engineer corps and the medical corps, the membership of which boards has not yet been selected. Examinations will be held in August for those officers of the supply corps who have become eligible in regular course for promotion in rank. The names of the junior officers of the supply corps who are due for promotion have heretofore been published in these columns.—*Army and Navy Register,* 27 May, 1922.

NAVAL CATAPULT TRIALS.—The airplane-discharging catapult installed recently on board the battleship *Maryland,* flagship of the Atlantic fleet, was given its first test with an airplane at Yorktown, Va., on May 24 in the presence of Admiral Hilary P. Jones, commander-in-chief of the fleet, and his staff and aviation officers from the bureau of aeronautics, naval air station at Hampton Roards, and the airplane carrier *Langley.* A Vought pursuit seaplane of the single float type was used. The machine was piloted by Lieutenant Andrew C. McFall, with Lieutenant DeWitte C. Ramsey, aviation aide to Admiral Jones, as passenger. Only one discharge was attempted. The machine took off satisfactorily and everything pertaining to the mechanism functioned perfectly.—*Army and Navy Register,* 27 May, 1922.

BATTLESHIP "UTAH" TO BE DOCKED AT PORTSMOUTH.—The United States battleship *Utah* will arrive at Portsmouth today (Wednesday) to be placed in the floating dock. She is to remain in port about two weeks, and will give leave to officers and men during this period.—*Naval and Military Record,* 11 May, 1922.

MONTHLY RATES OF PAY AND ALLOWANCES OF OFFICERS OF THE ARMY, EFFECTIVE JULY 1, 1922

Grade.	Pay period	Annual base pay	Less than three years' service	Over three years' service	Over five years' service	Over six years' service	Over seven years' service	Over nine years' service	Over ten years' service	Over twelve years' service	Over seventeen years' service	Over fifteen years' service	Over fourteen years' service
General of the Armies of the U. S.		13,500	1,125.00	1,125.00	1,125.00	1,125.00	1,125.00	1,125.00	1,125.00	1,125.00	1,125.00	1,125.00	1,125.00
Major general		8,000	666.67	666.67	666.67	666.67	666.67	666.67	666.67	666.67	666.67	666.67	666.67
Brigadier general		6,000	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00
Colonel:													
Over 26 years' service	6	4,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
First appointment above captain	6	4,000	333.33	350.00	350.00	366.67	366.67	383.33	383.33	400.00	400.00	416.67	416.67
Appointed under section 24, act June 4, 1920	6	4,000	333.33	350.00	350.00	366.67	366.67	383.33	383.33	400.00	400.00	416.67	416.67
Less than 26 years' service	5	3,500	291.67	306.25	306.25	320.83	320.83	335.42	335.42	350.00	350.00	364.58	364.58
Lieutenant colonel:													
Over 30 years' service	6	4,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Over 20, less than 30 years	5	3,500	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
First appointment above captain	5	3,500	291.67	306.25	306.25	320.83	320.83	335.42	335.42	350.00	350.00	364.58	364.58
Appointed under section 24, act June 4 1920	5	3,500	291.67	306.25	306.25	320.83	320.83	335.42	335.42	335.00	350.00	364.58	364.58
Less than 20 years' service	4	3,000	250.00	262.50	262.50	275.00	275.00	287.50	287.50	300.00	300.00	312.50	312.50
Major:													
Over 23 years' service	5	3,500	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Over 14, less than 23 years	4	3,000	.....	.....	.....	.....	.....	.....	.....	.....	300.00	312.50	312.50
First appointment above 2d lieutenant	4	3,000	250.00	262.50	262.50	275.00	275.00	287.50	287.50	300.00	300.00	312.50	312.50
Appointed under section 24, act June 4 1920	4	3,000	250.00	262.50	262.50	275.00	175.00	287.50	287.50	300.00	300.00	312.50	312.50
Less than 14 years' service	3	2,400	200.00	210.00	210.00	220.00	220.00	230.00	230.00	240.00	.....	.....	.....
Captain:													
Over 17 years' service	4	3,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	312.50
Over 7, less than 17 years	3	2,400	.....	.....	.....	.....	220.00	230.00	230.00	240.00	240.00	250.00	.....
First appointment above 2d lieutenant	3	2,400	200.00	210.00	210.00	220.00	220.00	230.00	230.00	240.00	240.00	250.00	.....
Present rank July 1, 1920, or earlier	3	2,400	200.00	210.00	210.00	220.00	220.00	230.00	230.00	240.00	240.00	250.00	.....
Less than 7 years' service	2	2,000	166.67	175.00	175.00	183.33	.....	.....	.....	.....	.....	.....	.....
First lieutenant:													
Over 10 years' service	3	2,400	.....	.....	.....	.....	.....	.....	.....	230.00	240.00	240.00	250.00	250.00
Over 3, less than 10 years	2	2,000	.....	175.00	175.00	183.33	183.33	191.67	.....	.....	.....	.....	.....
First appointment above 2d lieutenant	2	2,000	166.67	175.00	175.00	183.33	183.33	191.67	.....	.....	.....	.....	.....
Less than 3 years' service	1	1,500	125.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Second lieutenant:													
Over 5 years' service	2	2,000	.....	.....	175.00	183.33	183.33	191.67	191.67	200.00	200.00	208.33	208.33
Less than 5 years' service	1	1,500	125.00	131.25	.....	.....	.....	.....	.....	.....	.....	.....	.....

Monthly Rates of Pay and Allowances of Officers of the Army, Effective July 1, 1922

Grade;	Over eighteen years' service	Over twenty years' service	Over twenty-one years' service	Over twenty-three years' service	Over twenty-four years' service	Over twenty-six years' service	Over twenty-seven years' service	Over thirty years' service	Rental and subsistence allowances for fiscal year 1923. RENTAL With dependents	RENTAL No dependents	SUBSISTENCE (30-day month) With dependents	SUBSISTENCE (30-day month) No dependents
General of the Armies of the U. S.	1,125.00	1,125.00	1,125.00	1,125.00	1,125.00	1,125.00	1,125.00	1,125.00	(a)	(a)	(a and b)	(a and b)
Major general	666.67	666.67	666.67	666.67	666.67	666.67	666.67	666.67	$120	$80	$36	$18
Brigadier general	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	120	80	36	18
Colonel:												
Over 26 years' service	.....	.....	.....	.....	.....	466.67	483.33	500.00	120	80	36	18
First appointment above captain	433.33	433.33	450.00	450.00	466.67	466.67	483.33	500.00	120	80	36	18
Appointed under section 24, act June 4, 1920	433.33	433.33	450.00	450.00	466.67	466.67	483.33	500.00	120	80	36	18
Less than 26 years' service	379.17	379.17	393.75	393.75	408.33	.....	.....	.....	120	80	54	18
Lieutenant colonel:												
Over 30 years' service	.....	.....	.....	.....	.....	.....	.....	479.17	120	80	36	18
Over 20, less than 30 years	.....	379.17	393.75	393.75	408.33	408.33	422.92	.....	120	80	54	18
First appointment above captain	379.17	379.17	393.75	393.75	408.33	408.33	422.92	.....	120	80	54	18
Appointed under section 24, act June 4, 1920	379.17	379.17	393.75	393.75	408.33	408.33	422.92	.....	120	80	54	18
Less than 20 years' service	325.00	.....	.....	.....	.....	.....	.....	.....	100	60	54	18
Major:												
Over 23 years' service	.....	.....	.....	393.75	408.33	408.33	422.92	437.50	120	80	54	18
Over 14, less than 23 years	325.00	325.00	337.50	.....	.....	.....	.....	.....	100	60	54	18
First appointment above 2d lieutenant	325.00	325.00	337.50	.....	.....	.....	.....	.....	100	60	54	18
Appointed under section 24, act June 4, 1920	325.00	325.00	337.50	.....	.....	.....	.....	.....	100	60	54	18
Less than 14 years' service	.....	.....	.....	.....	.....	.....	.....	.....	80	60	36	18
Captain:												
Over 17 years' service	325.00	325.00	337.50	337.50	350.00	350.00	362.50	375.00	100	60	54	18
Over 7, less than 17 years	.....	.....	.....	.....	.....	.....	.....	.....	80	60	36	18
First appointment above 2d lieutenant	.....	.....	.....	.....	.....	.....	.....	.....	80	60	36	18
Present rank July 1, 1920, or earlier	.....	.....	.....	.....	.....	.....	.....	.....	80	60	36	18
Less than 7 years' service	.....	.....	.....	.....	.....	.....	.....	.....	60	40	36	18
First lieutenant:												
Over 10 years' service	260.00	260.00	270.00	270.00	280.00	280.00	290.00	300.00	80	60	36	18
Over 3, less than 10 years	.....	.....	.....	.....	.....	.....	.....	.....	60	40	36	18
First appointment above 2d lieutenant	.....	.....	.....	.....	.....	.....	.....	.....	60	40	36	18
Less than 3 years' service	.....	.....	.....	.....	.....	.....	.....	.....	40	40	18	18
Second lieutenant:												
Over 5 years' service	216.67	216.67	225.00	225.00	233.33	233.33	241.67	250.00	60	40	36	18
Less than 5 years' service	.....	.....	.....	.....	.....	.....	.....	.....	40	40	18	18

(a) Allowances fixed by the President.
(b) Allowances in this column are on the basis of a month of 30 days. For a month of a greater or less number of days the amounts should be correspondingly increased or decreased.
Pay and allowances of officers of corresponding rank in other services are the same as for Army officers.—*Army and Navy Register*, 27 May, 1922.

(a) Allowances fixed by the President.
(b) Allowances in this column are on the basis of a month of 30 days. For a month of a greater or less number of days the amounts should be correspondingly increased or decreased.
Pay and allowances of officers of corresponding rank in other services are the same as those of Army officers.—*Army and Navy Register*, 27 May, 1922.

PAY AND ALLOWANCES OF CHIEF WARRANT OFFICERS, U. S. NAVY

	PAY											ALLOWANCES WITH DEPENDENTS		ALLOWANCES WITHOUT DEPENDENTS	
												*Rental allowance	Subsistence allowance	*Rental allowance	Subsistence allowance
After 12 years' commissioned service...	Over 12 years $2,880	Over 15 years $3,000	Over 18 years $3,120	Over 21 years $3,240	Over 24 years $3,360	Over 27 years $3,480	Over 30 years $3,600					960	438	720	219
After 6 years' commissioned service.....	Over 6 years 2,200	Over 9 years 2,300	Over 12 years 2,400	Over 15 years 2,500	Over 18 years 2,600	Over 21 years 2,700	Over 24 years 2, 800	Over 27 years $2,900	Over 30 years $3,000			720	438	480	219
With less than 6 years' commissioned service	Under 3 years 1,500	Over 3 years 1,575	Over 6 years 1,650	Over 9 years 1,725	Over 12 years 1,800	Over 15 years 1,875	Over 18 years 1,950	Over 21 years 2,025	Over 24 years 2,100	Over 27 years $2,175	30 years $2,250	480	219	480	219

*Rental allowances do not accrue to any officer on shore duty furnished public quarters or to officers without dependents when on sea or field duty.

NOTE

The rates of pay shown in the above table become effective on July 1, 1922, for all chief warrant officers except: That those officers whose base pay plus longevity (under the act of May 13, 1908) is, on June 30, 1922, in excess of their pay as given above, shall continue to receive the base play plus longevity to which entitled on June 30, 1922, until such time as their pay under the above table exceeds this amount.—*Army and Navy Register*, 27 May, 1922.

Pay and Allowances of Warrant Officers, U. S. Navy

	Less than 4 years' service	Over 4 years' service	Over 8 years service	Over 12 years' service	Over 16 years' service	Over 20 years' service
Army mine planter service:						
Master	185.00	194.25	203.50	212.75	222.00	231.25
First mate	141.00	148.05	155.10	162.15	169.20	176.25
Second mate	109.00	114.45	119.90	125.35	130.80	136.25
Chief engineer	175.00	183.75	192.50	201.25	210.00	218.75
Assistant engineer	120.00	126.00	132.00	138.00	144.00	150.00
Other warrant officers	148.00	155.40	162.80	170.20	177.60	185.00

—*Army and Navy Register*, 27 May, 1922.

Pay of Enlisted Personnel of the Navy and Coast Guard Under Joint Service Pay Bill

Grade	Base pay first 4 years' service	B. P. plus 10% second 4 years' service	B. P. plus 15% third 4 years' service	B. P. plus 20% fourth 4 years' service	B. P. plus 25% after 16 years' service
First					
C. P. O. with permanent appointment	$126	$138.60	$144.90	$151.20	$157.50
C. P. O. with acting appointment	99	108.90	113.85	118.80	123.75
Second					
Petty officer, 1c.; cabin steward, and cooks	84	92.40	96.60	100.80	105.00
Third					
Petty officer, 2c.; wardroom stewards, and cooks, steerage steward and cooks	72	79.20	82.80	86.40	90.00
Fourth					
Petty officer, 3c.; fireman, 1c.; warrant officer, stewards and cooks	60	66.00	69.00	72.00	75.00
Fifth					
Nonrated men, 1c.; fireman, 2c., and mess attendant, 1c	54	59.40	62.10	64.80	67.50
Sixth					
Nonrated men, 2c.; fireman, 3c., and mess attendant, 2c	36	39.60	41.40	43.20	45.00
Seventh					
App. sea. and mess attendant, 3c	21	23.10	24.15	25.20	26.25

Notes.—Any enlisted man in the navy on June 30, 1922, whose base pay plus permanent additions exceeds the rate of pay provided above for his rating and length of service shall continue to receive his old base pay plus permanent additions during the remainder of his enlistment (or extension entered into prior to July 1, 1922, so long as his rating is not changed. Any "change in rating" or enlistment or extensions entered into on or subsequent to July 1, 1922, shall carry the above rates of pay.

The secretaries of the navy and treasury are authorized to fix the pay grades for the various enlisted ratings in the navy and coast guard.

Mates in the navy will receive the pay of the first grade of enlisted men.

The pay of the insular force of the navy shall be one-half the rates of pay prescribed for corresponding ratings in the navy.

Present reenlistment gratuity is repealed, and in lieu thereof an enlistment allowance of $50 for each year served in the previous enlistment (not to exceed $200) for the first three grades and $25 for each year (not to exceed $100) for the other grades for reenlistment on honorable discharge within 3 months.

Retired men will have their retired pay computed on the basis of the new schedule after July 1.—*Army and Navy Register*, 27 May, 1922.

NEW NAVY UNIFORM REGULATIONS.—Departmental approval has been given to the changes in the navy uniform regulations, which have been brought about as a result of the deliberations of a special board convened at Hampton Roads last winter, composed of Rear Admiral Hugh Rodman, president, and Rear Admiral Philip Andrews and Captain R. Z. Johnston, members, with Lieutenant F. C. Fechteler, recorder. The board's report bears date of March 23, but the matter has been under consideration in the bureau of navigation and by the secretary of the navy for several weeks. Secretary Denby prior to his departure for the Orient approved

the regulations, subject to some changes which will be made in the bureau of navigation. It is probable that some minor changes will necessarily be made after the officer's uniform shop has gone over the specifications, so as to avoid the inclusion of any innovation which would be impracticable from a tailoring point of view.

The task of rewriting the uniform regulations and preparing them for the printer and the publication of the regulations to the naval service will probably consume several months. While the changes will not become effective until they have been published to the service, existing orders require every officer in the navy to be equipped with the required uniform outfit by the first of July of this year.

As we have heretofore predicted, the changes as recommended by the bureau of navigation and approved by the secretary contain nothing of a radical nature or which would arouse controversy, and no changes are made which would cause undue expense. A recommendation of the majority of the board that the buttons on the officers' overcoat be changed from brass to black was not adopted and the overcoat buttons remain as they are. No change in the sleeve insignia of staff officers was approved. No recommendation regarding the uniform of bluejackets will prevent the eventual issue of the millions of dollars worth of uniforms still in stock as the result of war purchases. The chief petty officers, however, will have a neat, light raincoat for wear ashore.

The officers' cap is increased in size, but the insignia on the visor remains the same; the chief petty officers' cap is also broadened in the crown. Some slight changes have been made in the method of wearing decorations, badges and ribbons, and the word "medals" as it now appears in the regulations will be changed to "decorations." The word "forestry" is omitted from the uniform regulations, that being a trade name. Overcoats and raincoats for officers will reach one-third the distance from the knee-cap to the ground.

The New Overcoat

The new specifications adopted for the officers' overcoat read as follows:

Overcoat—Double breasted, smooth-faced cloth, lined with black material, semifitting at waist, full skirt, reaching one-third the distance from the knee-cap to the ground, shaped at waist, and held by half-belt at back, lapel and convertible collar, so that it may be worn buttoned to the neck if desired, fitted with latch in front of collar, collar to be 4½ inches wide at center of back, point of lapel to be as wide as point of collar, the two to be closely together, notch of lapel about 4½ inches deep, length of lapel about 11 inches, two rows of 5 medium-sized navy brass buttons about 6 inches apart, first button at neck under collar, second at bottom of lapel, bottom button at height of crotch, four lower buttons equally spaced, vent in center of back from 16 to 25 inches from bottom, fitted with three small navy black buttons, the right side overlaping the left 2 inches, vertical slit 4 inches long over left hip for sword belt slings, so that sword may be worn on outside, slit fitted with flap, coat to be full in back, fitted with straps let into side seams at waist each 2¼ inches wide, right strap fitted with two medium-sized navy black buttons 3 inches apart, left strap with two buttonholes similarly spaced, two outside welted pockets, welts 1⅝ inches wide, openings 8 inches long, center of opening in same, vertical line with front seam of armhole at height of hip bone, bottom of opening 2 inches to the rear of upper one, inside pockets at discretion, edges of collar, back straps, pocket welts and front edges of coat stitched with one row of plain stitching ½-inch from edges, all seams plain, sleeve markings of lustrous black mohair braid to designate rank only, shoulders fitted for shoulder marks, which will always be worn with overcoats.

New Regulations for Cap

Caps, Blue, White and Aviation—Frame so constructed that a blue cloth, white duck, green and khaki cover may be fitted, to be stiff, standing and flaring throughout its circumference so that the center edge of the cover may have a rolled or rounded effect rather than one having a thin edge, general measurements with cover on, length of crown 10 inches, width 9½ inches, height in rear from bottom of frame 2¾ inches, in front from visor to top 3¾ inches, covers to be without welt, neatly stitched on each side, crown distended by stiffening in frame all around, band 1½ inches wide with welt ⅛ inch at top and bottom, lower welt ⅛ inch from base of cap, band of lustrous black mohair braid around cap between welts and visors as described in paragraph 33 for the different grades, sloping downward at an angle of 35 degrees, rounded, lined underneath with green leather, bordered with narrow strip of patent leather 3/16 inch wide, light colored leather sweat band from base of cap within 1 inch of top, chin strap of leather faced with ½ inch gold lace for commissioned officers, ¼ inch for warrant officers, fitted with two gold lace slides of corresponding widths, strap fastened at its ends with two small-sized screweye navy buttons spaced about 12 inches apart, strap to rest on upper edge of visor, device embroidered on band and backing combined, so that one-half will show above the band. Device embroidered that it may be inscribed in a circle 2½ inches in diameter for commissioned officers, gold crossed foul anchors, superimposed by silver shield, surmounted by silver spread eagle; for warrant officers the crossed anchors without shield or eagle.

New Mess Jacket

Mess Jacket—Similar in cut to body of evening dress coat, but to descend to hips to fully cover top of trousers, slightly roached over hips, peaked behind, two buttonholes, on each side below lapel, 3 inches apart, 1½ inches from edge, two medium-sized brass buttons on each side below lapel abreast buttonholes, 2 inches from edge, shoulders fitted for shoulder marks which should be worn with this uniform, to be held together by two linked medium-sized brass buttons.—*Army and Navy Register*, 27 May 1922.

BOARD'S LOSS LESS IN APRIL.—Expenses of the shipping board for April in excess of income from vessel operations, including overhead, repairs, insurance and lay up expenses, amounted to $2,977,246, compared with an excess of expenses over income for March of $3,704,155. This is the most favorable monthly result obtained since the present board took office.

Voyages reported for March totaled 188, compared with 185 for April.

The net excess of outlay over income on voyage operations for April, excluding overhead, repairs and insurance, was announced as $667,751, compared to $1,019,860 for March, the improvement being attributed to increased revenues from cargo vessels and to better results obtained in the operation of passenger vessels. Operation of the passenger vessels for April showed an excess of income over outlay, excluding overhead, repairs and insurance, of $64,853.

These favorable results were obtained despite a decrease in tanker voyages. Tanker voyages in March were 37 and in April 32, and the excess of income over outlay for April was $142,732, as against $290,868 for March. Charter hire receipts for the month of April were $74,108, as against $88,139 for the month of March. The lay-up expenses increased from $381,038 in March to $433,839 in April.

The favorable outcome for April was attained with but slight increase in the gross revenues received, the gross revenues for April exceeding March by only $86,116. The improvement in the operating results as

compared with the previous month amounting to $726,908 has been largely accomplished by the operating economies instituted and the consequent reduction in the operating expenses.

The largest saving was in the outlay for repairs, which in March amounted to $1,313,299, as compared with $917,985 for the month of April.

In its accounting the board does not figure capital charges and several forms of insurance which the board carries itself. These omissions are in line with established Government practice, but this inability to make a proper allowance for capital charges in these monthly statements results in a failure to give a true picture of the losses incurred by the board such as all commercial statements should reflect.

While the cost of operations for April was the lowest for any month in almost two years, Chairman Lasker does not desire the impression to be conveyed that this low figure could be consistently maintained throughout the year, inasmuch as April is one of the best months of the year in world shipping.—*Nautical Gazette,* 5 June, 1922.

APRIL SHIPBUILDING OUTPUT IN DETAIL.—The bureau of navigation, department of commerce, reports 106 sailing, steam, gas and unrigged vessels of 34,308 gross tons built in the United States and officially numbered during the month of April, 1922, as follows:

	Atlantic and Gulf		Pacific		Great Lakes		Western Waters		Total	
	No.	Gross No.	No.	Gross No.	No.	Gross No.	No.	Gross No.††	No.	Gross
WOOD										
Sailing	7	432	..	....	..	....	..	....	7	432
Steam	3	188	2	119	..	....	3	243	8	550
Gas	40	1,208	11	299	3	96	5	137	59	1,740
Unrigged	9	2,928	4	1,091	4	260	2	40	19	4,319
Total	59	4,756	17	1,509	7	356	10	420	93	7,041
METAL										
Sailing	..	....	..	....	..	....	..	....	....	....
Steam	2	17,930	1	15	1	54	..	....	4	17,999
Gas	3	8,310	..	....	..	....	3	67*	6	8,377
Unrigged	2	702	..	....	1	189	..	....	3	891
Total	7	26,942	1	15	2	243	3	67*	13	27,267
TOTALS										
Sailing	7	432	..	....	..	....	..	....	7	432
Steam	5	18,118	3	134	1	54	3	243	12	18,549
Gas	43	9,518	11	299	3	96	8	204	65	10,117
Unrigged	11	3,630	4	1,091	5	449	2	40	22	5,210
Grand Total	66	31,698	18	1,524	9	599	13	487*	106	34,308

*Includes 2 composite vessels of 21 gross tons.

The above total includes 31 rigged vessels of 1,319 gross tons and 14 unrigged vessels of 3,409 gross tons, total 45 vessels of 4,728 gross tons built in years previous to 1922. Of the above total, 1 vessel of 13,712 gross tons was built for the United States shipping board.

The largest of these vessels were the passenger steamer *Western World* built for the United States shipping board and the motorship *California* built for the American Hawaiian steamship company.—*Nautical Gazette,* 20 May, 1922.

SEAGOING STEEL TONNAGE, BUILDING AND CONTRACTED FOR IN THE UNITED STATES, AS OF MAY 1, 1922

Yard	Hull	Name	Type	Class	Gross	Owners	Machinery	H.P.	DIMENSIONS L.	B.	D.	Fuel	Remarks
Beth. S. B. Cpn., Ltd., Sparrows Point Plant	4197	*Western World*	Pass. Cargo	A.B.	10,500	U. S. Shipping Board	Turbines	12000	518	72	50	Oil	
	4212	*Marore*	Oil & Ore	A.B.	13,500	International Pet.	Turbines	....	550	72	44	Oil	Combination Carrier
	4213	*Steelore*	Oil & Ore	A.B.	13,500	International Pet.	Turbines	....	550	72	44	Oil	Combination Carrier
Alameda Plant	5309	*Chilore*	Coal & Ore	A.B.	13,500	Ore Steamship Co.	Reciproc.	....	550	72	44	Oil	Combination Carrier
	5310	*Lebore*	Coal & Ore	A.B.	13,500	Ore Steamship Co.	Reciproc.	....	550	72	44	Oil	Combination Carrier
Federal S.B. Co.	68		Cargo	A.B.	6,000	U. S. Steel Prod.	Turbine	3500	442	56	30	Coal or Oil	
	72		Pass. & Cargo	A.B.	5,000	Merchant & Miners	Reciproc.	2700	350	52	35	Oil	
	73		Pass. & Cargo	A.B.	5,000	Merchant & Miners	Reciproc.	2700	350	52	35	Oil	
Great Lakes Engineering	242		Cargo	A.B.	6,585	Wilson Transit Co.	Reciproc.	1900	580	60	32	Coal	G. L. service
Manitowoc S.B. Co.	204		Cargo	A.B.	4,900		Reciproc.	1650	430	56	34	Coal	G. L. service
Merchant S. B. Cpn.	385	*Californian*	Cargo	Dual	7,800	Am. Hawaiian S. S. Co.	Diesel	4500	445	60	39	Oil	
	386	*Missourian*	Cargo	Dual	7,800	Am. Hawaiian S. S. Co	Diesel	4500	445	60	39	Oil	
New York S. B. Cpn.	264	*Eurana*	Tanker	Dual	6,800	Builders account	Reciproc.	3000	420	57	32	Oil	
	265		Tanker	Dual	6,800	Builders account	Reciproc.	3000	420	57	32	Oil	
Pusey & Jones	1020		Pass. Cargo	A.B.	2,710	Seaboard Bay Line	Reciproc.	2860	330	58	19	Coal	Coastwise
	1021		Pass. Cargo	A.B.	2,710	Seaboard Bay Line	Reciproc.	2860	330	58	19	Coal	Coastwise
Sun S. B. Cpn.	42	*Pennsylvania Sun*	Tanker	Dual	9,000	A. G. W. I.	Reciproc.	4500	...	..	..		
	53		Pass. Cargo	A.B.	4,000	Inter-Island Nav. Co.	Reciproc.	5600	...	..	..		
Tebo Yacht Basin	21	*Cynthia*	Passenger	A.B.	350	M. B. Mills	Diesel	450	129	23	12	Oil	Yacht

—*Bulletin*, American Bureau of Shipping, May-June, 1922.

PANAMA CANAL TRAFFIC.—During March 234 commercial vessels of 776,034 net tons passed through the Panama Canal carrying 960,089 tons of cargo. In the corresponding month of last year 255 ships of 1,112,818 tons and carrying 1,084,563 tons of cargo passed through the waterway. The showing by countries follows:

Nationality	No. of Ships	Net Tons	Tons of Cargo
British	75	233,310	287,319
Chilean	4	7,842	1,693
Danish	2	7,251	13,970
Dutch	5	13,026	18,173
French	6	19,625	26,259
German	5	11,064	12,170
Italian	1	3,579	1,400
Japanese	12	47,268	81,812
Norwegian	13	35,498	43,336
Peruvian	5	11,708	4,326
Swedish	3	6,507	10,366
United States	103	379,356	459,265
Totals	234	776 034	960,089

—*Nautical Gazette,* 20 April, 1922.

"GREAT NORTHERN'S" ACCIDENT.—While the *H. F. Alexander,* formerly the *Great Northern,* was proceeding down the Delaware River on her maiden trip since her reconditioning, she collided with the British freighter *Andree,* which sank. Both Captain Lustie and Chief Engineer Clayton, who were on the *H. F. Alexander,* were acting in a similar capacity on her sister ship, the *Northern Pacific,* when she burned. It looks as though these gentlemen must have walked under a ladder.—*Nautical Gazette,* 27 May, 1922.

"GEORGE WASHINGTON" REPAIRED IN RECORD TIME.—The liner *George Washington* had recently to undergo some repairs, which the German Bremerhaven yard estimated would take nine days of twenty-four hours each and a New York yard six days. As the vessel was in the trans-Atlantic service, making regular scheduled trips, it was impossible to lay her up for that length of time. The shipping board therefore arranged to have the work done in the Boston navy yard, where she arrived Monday, May 1, at 3:30 P. M.

After this great ship had been docked the repairs, consisting of removing propellers, hauling shafts, rewooding bearings and putting on two coats of bottom paint, were completed at noon Thursday, May 4, the actual number of hours being sixty-four.—*Nautical Gazette,* 27 May, 1922.

"LEVIATHAN'S" NAME TO REMAIN.—In a formal letter, President Harding has requested the shipping board not to rechristen the *Leviathan* after himself but to allow her present name to remain. While not insensible to the proffered compliment, the President says that it would be a mistake to give the *Leviathan* another appellation as her present name stands as a national sentiment and one that symbolizes the participation of this great vessel in the world war. The board has acceded to the President's wish and has rescinded its action in changing the name of its largest ship.—*Nautical Gazette,* 20 May, 1922.

AERONAUTICS

THE AIRSHIP OF THE FUTURE.—"The airship of the future will be of all-metal construction, which will be of fundamental assistance in the development of these craft for world-wide commercial use in aerial transportation," according to Herman T. Kraft, chief aeronautical engineer of the Goodyear Tire and Rubber company.

Two factors must be considered above all others in the construction of airships of any kind, namely safety and durability, in Mr. Kraft's opinion. There must be absolute protection against structural failure as well as against fire. As long as airships are constructed of inflammable materials, there will always be some danger of fire, especially with the use of hydrogen gas.

Uniform distribution of strength, which is the major basis of safety, is exceedingly difficult to obtain even in a rigid airship because of the very complicated calculations necessary to be sure of safety, since we have to figure unknown factors and allow for them in every airship we build. With an all-metal ship it will be possible to make those calculations much more exact than was hitherto the case, owing chiefly to the reduction of the number of small riveted parts.

The entire surface of the ship will be of metal, thereby assuring greater durability and reduction of fire hazard. Tests have been made which indicate that even hydrogen ignited on the surface of an all-metal container will burn freely without heating up the metal, so that there would be no danger of the envelope being consumed by the flame.

Unquestionably the building of such a ship would be a mammoth undertaking, but with the present engineering knowledge available its construction would be entirely practicable. Indeed it has been attempted before, so far back as 1897, and a flight was actually made with an all-metal ship with conical ends and cylindrical body. This ship was not a success, chiefly because engineering knowledge had not progressed sufficiently in aeronautics, and proper construction materials were not available.

Aluminum sheeting would doubtless be the metal employed, with strips of very flexible non-inflammable material or wire lacing interposed at various points to take care of the flexing of the envelope while in flight. Approximately 1,000,000 cubic feet capacity, with a theoretical length of 350 feet and a maximum diameter of about 75 feet would be the proper size of ship to make to prove its practicability.

In any consideration of all-metal ships, the question of gas-tight seams has generally been a bugbear, but it has now been conclusively proven that the seams in such a ship can be made gas-tight, especially in a container carrying low pressures. The actual building would be somewhat of a problem even in a thoroughly modern plant, but by using airbags to keep lifting the ship progressively, while under construction, and erecting superstructures in the hangars the riveting, lacing and assembling could easily be handled. The rigidity of the structure, which would have some degree of flexibility, would eliminate many of the structural difficulties in rigid airships of the present design.—*Aviation,* 29 May, 1922.

SOME NAVAL AVIATION DEVELOPMENTS.—One of the important accomplishments in aviation by the navy during the past year was the successful development of torpedo-carrying seaplanes. Three types have been produced under navy control and with navy funds by contractors. One type is an unbraced monoplane of low visibility and high speed. Another is made entirely of metal. The third is a small, compact biplane with interchangeable landing gear so that it can be used to land on a carrier or on the sea. To meet the special demand of the navy for a small combat plane of high performance, and yet very compact and easily taken down for stowage, there has been designed and built in the naval shops, and successfully flown, a new machine equipped with the new Lawrence air-cooled engine developed with naval funds for this project. The successful consummation of the combined project of a radically new type of both engine and plane was very difficult from a technical standpoint, but it has proved remarkably successful.

Production of American-made duralumin by and for the navy has made it possible for airplane builders to make use of that material in airplane construction. One navy contractor today is flying for test a torpedo plane built all of duralumin, and this is the first all-metal airplane built by an American contractor. Another navy contractor is building all-metal spotting planes for the fleet, and others are using metal in a large part of their construction.—*Army and Navy Register,* 20 May, 1922.

BRITISH SAFETY FUEL TANK AWARDS.—The British air ministry announces: The prizes in the Air Ministry Competition for Safety Fuel Tanks for Aircraft have been awarded as follows:

First Prize—£1,400. The India-Rubber, Gutta Percha and Telegraph Works company, Limited, Silvertown, London, E. 16.

Second Prize—£400. Imber, Anti-Fire Tanks, Limited, West Road, Tottenham, London, N. 17.

Third Prize—£200. Commander F. L. M. Boothby, (R. N. Retired) *Overway,* Tilford, Surrey.

The competition was arranged in order to promote the evolution of a reliable type of fuel tank for service and commercial aircraft, which would reduce the risk of fire, due to crashing or hostile action, to a minimum.

Twenty-six entries were received for the competition, which was open to the world, and eighteen different types of tanks were actually submitted for test.

The judges appointed by the air council consider that the competition has resulted in the achievement of the objects for which it was instituted and has produced a type of safety fuel tank which, although capable of improvement in several minor respects, is available for immediate introduction on service and civil aircraft and which, for a slight increase in weight over and above that of the standard service steel tank, gives almost complete immunity from fire, either in a crash or in action with enemy machines.

All the tanks tested, with a few exceptions, showed marked superiority in almost every respect over the standard Service steel tank now generally in use.

The judges were: Group Captain E. F. Briggs, (deputy director of research; Major B. C. Carter (directorate on research); Major J. H. Ledeboer (directorate of research); Mr. G. Cockburn (accidents investigation branch); Major J. P. C. Cooper (accidents investigation branch); Mr. H. Grinsted (royal aircraft establishment).

The regulations governing the competition provided that each entrant had to submit two tanks for preliminary trials and that the three most successful competitors in the first stage should submit four more tanks for final trial.

Description of Winning Tanks

Details of the tanks submitted by the three winning competitors for the preliminary tests are as follows:

Tanks Submitted by India-Rubber and Gutta Percha Co., Ltd., Silvertown, London

	No. 1	No. 2
Weight of tank	78.75 lbs.	81.25 lbs.
Capacity of tank	37.7 gals.	38.2 gals.
Weight of gallon capacity	.58 lbs.	.66 lbs.
Shape of tank	Cubical	

Each consisted of a welded sheet steel rectangular tank with no frame or baffles of any sort, but with each side slightly dished inwards, inserted in a detachable rubber case.

These tanks were slung in the fuselage by means of webbing.

Tanks Submitted by Imber Anti-fire Tanks, Ltd., Tottenham, London

	No. 1	No. 2
Weight of tank	50 lbs.	51.5 lbs.
Capacity of tank	30 gals.	29.3 gals.
Weight per gallon capacity	1.66 lbs.	1.76 lbs.
Shape of tank	Elliptical	

The tank consisted of a light gauge, tinned steel shell which was separated from the inside of a framework of aluminum tubing and light gauge aluminum baffle plates. After assembly the whole of the tank had been covered with india-rubber of a suitable thickness, and all joints vulcanized.

Tanks Submitted by Commander Boothby, Tilford, Surrey

	No. 1	No. 2
Weight of tank	33.23 lbs.	35.75 lbs.
Capacity of tank	58 lbs.	66 lbs.
Weight per gallon capacity	56.8 gals.	53.7 gals.
Shape of tank	Cubical	

The tank consisted of an inner bag of 4-ply rubbered fabric capable of containing the petrol with an outer cover of rubbered fabric which was gas-tight. Non-inflammable gas was introduced into the space between the two shells and maintained under slight pressure. A drain pipe was fitted to the outer casting. The tank was fixed to the fuselage by rubber shock absorber and stringing and encased in 3-ply glued on.—*Aerial Age Weekly*, 22 May, 1922.

NAVY TO USE METAL SEAPLANES.—Secretary Denby of the navy department on May 7 authorized an announcement that the Glenn L. Martin Company of Cleveland, Ohio, has undertaken the development for the naval bureau of aeronautics of a number of seaplanes to be constructed of duralumin, a special alloy of metal, and to be used by the fleet for spotting gunfire at long ranges.

The construction of metal aircraft of duralumin is a departure for this firm, which hitherto has built planes of the ordinary wood and wire type such as the well-known Martin bombers which were used last summer in the aeroplane bombing attacks that destroyed a number of former German ships off the entrance to the Virginia capes.

The development of metal aircraft construction in the United States, Secretary Denby said, has been made possible by the navy department in that the special alloy metal, duralumin, originally developed in Germany, has been introduced to American manufacturers in connection with the construction of the rigid airship *ZR-1* at the naval aircraft factory at Philadelphia. This work has now progressed to the point, according to naval aviation experts, where duralumin of proper quantity, and in all of the useful shapes is now available to any aircraft builder from at least two American commercial sources. The naval aircraft factory at Philadelphia has also developed special machinery and processes for its fabrication.

Aircraft manufacturers transacting business with the bureau of aeronautics of the navy have been invited frequently to visit the factory at Philadelphia to observe the metal fabrication of the work that is going on there. Besides the construction of the giant rigid airship *ZR-1*, the parts of which are being manufactured at Philadelphia for erection at the naval air station at Lakehurst, the factory is also building metal wings, pontoons and other parts for seaplanes.

Just as the surface fleet of the navy passed by the stages of evolution through the era of wood into that of steel, so it is predicted by experts that the air fleet of the naval service will proceed from the period of wood and linen to that of metal.

Secretary Denby said that the Stout Engineering Laboratories, Inc., of Detroit, were also working with duralumin. This firm has received a contract from the navy department for the construction of experimental torpedo-carrying seaplanes to be built entirely of metal, and a simple machine of this character is now under trial flights. Other manufacturers in work for the navy, it was disclosed, have employed duralumin for parts of aeroplanes with success, notably the Gallaudet Aircraft Corporation of Providence, R. I., and the Aeromarine Plane and Motor Company of Keyport, N. J.

"It is expected," said Secretary Denby, "that future naval aircraft will be built of metal, to an increasing extent. The advantages of metal over wood are especially important for tropical service."—*Aerial Age Weekly*, 15 May, 1922.

THE BOOTHBY GAS ARMORED TANK.—The Boothby Gas Armored fuel tank, which gave extraordinarily good results in the recent British air ministry crash-proof tank tests, is an entirely new departure in aircraft tank construction. The design is based on Commander F. L. M. Boothby's observations that ballast bags dropped from airships did not burst badly on hitting the ground, especially if the bags were not full, combined with the result of tests made to fireproof gas bags by surrounding them with a layer of inert gas.

The tank is a fabric tank, and consists of an inner skin of balloon fabric, lined within with gold-beater's skin, a second container also of fabric, which serves as a safeguard in the event of the inner case leaking, and finally of an outer gas-tight casing filled with cooled exhaust from the engine.

This outer case may be of fabric or three-ply, and it is possible to use the fairing of the fuselage itself as part of this outer casing.

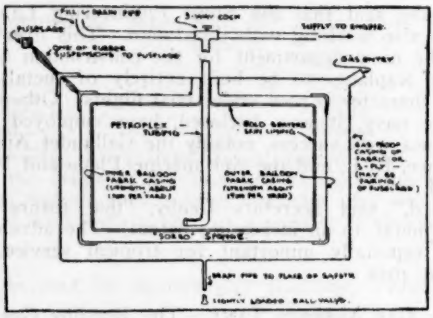
The two inner casings are supported from the fuselage on rubber shock absorbers, and to prevent swaying it is also suspended by light cords. These latter are so light that they will carry away in a crash before damage is done to the casing.

The design of petrol connections for a crash-proof tank presents difficulties for they are very liable to break in a crash, and a broken petrol pipe may be as dangerous as a punctured tank. In the Boothby tank there is a single sleeve passing through the top of the whole assembly. Into this fits tightly a length of smooth "Petroflex" tubing which reaches to the bottom of the tank, but which is only friction held in the sleeve, and can therefore pull through to a considerable extent if the tank carries away.

The outer casing is kept filled by exhaust gas taken from the engine through a small pipe long enough to cool the gas. The bottom of the gas compartment has an escape and drain pipe, fitted at its end with a lightly loaded release valve, and leading down to the undercarriage or some such place of safety. Thus the gas case is kept charged with exhaust, and if there is any petrol leakage from the inner castings the petrol is also drained off to a place of safety.

In the latest type of this tank the space between the two inner casings is filled with "Sorbo" sponge, which if punctured, as by a bullet, will swell on contact with petrol and close the hole.

The tank entered in the air ministry competition was not fitted with this sponge filling, and originally the air ministry agreed to allow the fairing of the fuselage to be used as a gas casing. The tank was designed to carry the specified quantity of 31.5 gallons, but as this type of tank requires to be only partially full to give the full extent of safety it was



actually capable of being filled to over 50 gallons, though it would not then have been crash-proof.

In the preliminary crash tests the tank did not leak at all, and was quite fit to repeat the test. About a week before the final tests the air ministry withdrew the concession that the fuselage fairing might be used as a gas container, and also said that if the tank was capable of containing more than 31.5 gallons it must be disqualified unde the rules of the competition. There was not time to design and build new tanks, so extemporized means were taken to reduce the volume, the outer casing was removed, and a rough gas casing was built inside the fuselage. The result was not as good as the original design. The crash proof qualities were about half those of the original, and the fireproof qualities were small. Nevertheless it stood five rounds of incendiary ammunition and only failed after ten rounds through one point of aim.

The sketch attached shows the general scheme very clearly. The single Petraflex tube leading out of the tank is connected to a three-way cock, so that one may either fill, drain, or supply the carbureter through it. The tank could be used for gravity feed, after starting a siphon action, or for petrol pump feed.

It may also be used for pressure feed. In this case, owing to the flexible nature of the tank, pressure may be applied outside, thus avoiding the risk of pumping impurities into the petrol container.

Finally it is a distinctly valuable feature that using this construction a crash-proof tank can be built for considerably less than that of the ordinary unprotected tinned steel type. The weight of the crash and fireproof type can be brought down to practically the same weight as the usual type.—*Aerial Age Weekly*, 29 May, 1922.

PORTUGUESE AIRMEN TO CONTINUE FLIGHT.—The Portuguese aviators, Captains Saccadura and Coutinho, sailed on May 9 from Rio Janerio for St. Paul Rock from Fernando Noronha on board the Portuguese cruiser *Republic*.

The airmen took with them their new seaplane sent from Portugal on the steamship *Bage*, which was unable to land the machine at the Rocks because of rough weather, bringing it on to Fernando Noronha. They expect shortly to resume their flight from Portugal to Brazil, cut short by the accident to their first seaplane in landing at St. Paul Rock last month.—*Aerial Age Weekly*, 22 May, 1922.

NEW NAVAL AIR EQUIPMENT.—Admiral Moffett, chief of the naval bureau of aeronautics, plans to equip floating forces with 213 air and sea planes during the coming year, it was learned recently in connection with

the presentation of the annual requirements of the bureau of aeronautics to the senate naval affairs committee. These planes are to be distributed among the eighteen battleships and other craft of the treaty fleet and two aircraft tenders or carriers, one on the Atlantic coast and the other on the Pacific.

Eighty-six VF planes, a fighting type, will become a permanent part of the fleet. They are new developments of the navy department, perfected since the war and are expected to cope with anything afloat in the air for some time to come. Besides these fighting craft, the ships afloat will carry 46 VO type spotters or observation planes carrying a crew of three men, and 27 of a similar single-seater type. There will also be 36 bombing and torpedo planes, to be known as VT planes. In place of the F5L's now serving as scouts, there will be requested eighteen newly perfected VS scout planes, bringing the total number of planes afloat with the fleet and tenders to 213. Four kite balloons have been requested for observation work.

Present plans indicate that each of the battleships will be equipped with four planes, two VF single seaters, one big VO spotter, and one VT, for torpedo and bomb carrying.

The recently developed catapults for launching planes from a ship at sea will soon be installed on each battleship. The ten new scout cruisers will also be equipped with planes and launching devices, according to present plans of the department.

Surface ships of the navy will no longer be at the mercy of aircraft, it is explained, as soon as they are equipped with these aircraft for defensive purposes. Fleet offensive power will be concentrated aboard the new aircraft carriers soon to be converted from the former battle cruisers *Lexington* and *Saratoga*. At present the U. S. S. *Wright* will be practically operated in this capacity although she is a tender or mother-ship. The *Langley*, an experimental carrier, will also be tried out as an aircraft carrier in anticipation of the receipt of the new ships.

It is understood that the marine corps is planning for the operation of twenty-four land planes, twelve as fighting craft and twelve for observation.

Shore stations of the navy will operate other craft, including about thirty torpedo and many training planes. At Pensacola today the navy has about sixty seaplanes and thirty-six land machines, which are used in the training of its pilot.—*Aviation*, 29 May, 1922.

HEAVY-OIL ENGINES FOR AIRCRAFT.—Much interest attaches to the announcement made by the national advisory committee for aeronautics in connection with its recent annual meeting that it was pursuing the development of a heavy-oil engine for use in aircraft. While the details of the invention are still held confidential, it is known that this engine is of the direct injection type which does away with both carburetor and spark plugs, the fuel being ignited by subjecting it to a suitable pressure.

The subject of heavy oil engines has such an important bearing on the future of aircraft, and in particular of airships, that it seems desirable to summarize here briefly the different aspects of the question.

The principal advantages to be derived from such an engine are: first, and foremost, safety from fire; second, fuel economy, which not only means lower fuel costs from the use of a much cheaper fuel than gasoline, but also, in all likelihood, greater weight economy in pounds of fuel consumed per horsepower hour.

We may reasonably expect at the same time some disadvantages in the heavy-oil engine. Chief among these appear a greater fixed weight of the power plant, and perhaps also a decreased flexibility of control. The great problem that must be solved will be so to work out the design that the latter two items will at least remain within practical bounds, while

preserving the reliability and, if possible, increasing it over that of present aircraft engines.

The light-weight heavy-oil engine, merely desirable today, will be the more necessary in the future as the demand for liquid fuel increases and the supply falls off. In the more distant future there may be foreseen the need of still another change—which we hope will be worked out before the need actually arises—the utilization of coal dust by direct injection in the engine.—*Aviation*, 8 May, 1922.

ORIGIN AND POSSIBILITIES OF "CURRENIUM."—(Dr. Edward Curran of Los Angeles, who has developed the new gas called "Currenium," has prepared for *Aviation* the following statement regarding it.)

This gas has been developed through a number of years of research made in the hope of producing a levitating gas for aircraft as good as, if not better than, hydrogen, but without its inflammable and explosive qualities, and which might be commercially efficient as well. I became first impressed with the possibilities of aeronautics at Chicago in 1893, and as I observed balloons the desirability of a safe and inexpensive gas seemed to be more and more important as an essential in effecting practical travel through the air. I studied over this a great deal, and my liking for chemistry and bacteriology probably led me to consider the problem more from the laboratory viewpoint than as a ballonist. At any rate, I began to reason the matter out and, as soon as I could, to make experiments.

Atomic Activity and Organic Changes

These were interesting, but not profitable and not always exactly safe. I had several "blow-ups" in getting acquainted with the qualities of hydrogen, but they strengthened my belief that a safer gas must be found. Finally, after some years of trying to get at elementals, I began to appreciate certain fundamental principles regarding atomic activity and organic changes. Atomic weight and specific heat are inverse concomitants—as one increases the other concomitantly decreases. We know, too, that through all material differentiations from a condition of utmost diffusion, or ultimate attentuation, with the least definity of matter and its motions to its greatest concentration, density and definiteness of motion, progressions which involve a state of gasefaction, of liquifaction, and even down to the state of greatest solidification of matter, accompanied, I believe, by increasing radiation of energy, both in amount and kind, there is an inexorable tendency to invest the greatest quantity of atomic matter, of the highest heterogeneity and of the least relative volumetric proportions, with the greatest amount of contained energy of paralleled heterogeneity. As we ascend the incline of organic developments, the higher we go the greater we find the demand for, and the greater are the quantitative absorption and redistribution of, radial forces of increasing heterogeneous wavelengths, amplitudes and intensities. All tend, as I have said, toward the endowment of the least quantity of matter of highest quality, universally and advolutionarily, with the greatest amount of contained and radiant energy having the least amount of heat-generating effect on surrounding and adjoining matter.

Is Hydrogen the Lightest Gas?

We cannot say finally that hydrogen is the lightest gas, although we have said that it is the lightest and terrestially identified gas. When light from our chomosphere is spectroheliographically analyzed the existence of gases or elements lighter than hydrogen is revealed, while the spectroscopical analysis of light from some stellar formations yields similar, or even more decided, manifestations in this direction. This would indicate to us that elementary formations and their atomic weights—no two of

which are the same—are varied to infinity and beyond the conception of our minds.

In my investigations I found that the atomic valency may be varied, and also that the affinity of one given element for another given element may be increased or decreased or even totally destroyed. I found, too, that elecricity is the primary cause of all material differentiations and that heat is the secondary cause; also that when such differentiations occur, as, and when the electrical and thermal conditions appertaining to matter conjoin, regardless of whether such conjunction may be naturally or artificially induced, at various stages of motion, phases of progression or states of heterogeneity, a transformation of the element is accomplished. This transformation may be said to be permanent until the contained electrical and remaining radial energy conjoin to induce other corresponding transformation.

By a method developed from these research results I have been able to vary atomic valency and produce a gas which is load-lifting or levitating and which is without dangerous inflammable and explosive qualities of hydrogen. It is commercially producible, which is equally as important a consideration as to make it dependable. At present I am justified in asserting that this gas is fully as serviceable and as cheap as hydrogen, with added qualities of practical value, but I feel that the process by which I produce it may make even a lighter gas. It will be feasible so to vary atomic weights that a gas may be produced of even greater lift—how far we may ultimately go in this I hesitate to conjecture. Hydrogen may be harnessable under certain circumstances, and it is obtainable in unlimited quantities at an economical rate, but it will not be considered safe enough to secure public confidence. Helium is difficult to produce with commercial efficiency, and it cannot be produced in all parts of the world; under present production methods, there is a limited supply which is restricted to the United States. There is a great need for a gas as safe as helium, but with greater buoyancy and producible anywhere at a cheap rate.

Formula Still a Secret

It will be readily seen that I cannot give the formula for producing this gas at present, for it is not fully protected. The demonstrations, chemically made, which have been made thus far are not as satisfactory as will be the case when a complete production plant can be made available—a situation, which I hope will be realized before the end of 1922. It should be possible, however, from what I have outlined, to note the manner in which this gas is produced. Machinery in large part already obtainable can be used in production, but the process will not be so expensive as that involved in securing helium. The materials required may be made available in any part of the world at an expensive rate. Electric power will be necessary for production on an economical basis.—*Aviation*, 22 May, 1922.

THE FLIGHT AROUND THE WORLD.—Major Wilfred Blake and Captain Norman Macmillan set forth on their historic around-the-world flight on May 24. The Aircraft Disposal company has, with commendable sporting spirit, placed four machines at their disposal, and the project appears to give fair promise of success. The machines to be used, although not of new types, have stood the test of time, and, given reasonable luck, the aviators should have a very good chance of getting through. Although as a sporting effort the use of a single machine for the entire flight would have been more spectacular, the employment of four machines, of three different types, will be a much closer representation of the actual conditions which will obtain when we come to run really long-distance serv-

ices, and from that point of view is, perhaps, of even greater practical value.

Two of the machines will be DH9's (three-seaters) with Siddeley "Puma" engines. One will be a Fairey twin-float seaplane of the famous F. III type, which has a Rolls-Royce "Eagle" engine, and the fourth will be a flying boat of the F type.

In the main, the route to be followed by Major Blake and Captain Macmillan will be the same as that planned by Sir Ross Smith. The last "leg," however, will be different from that planned by Sir Ross Smith, who, it will be remembered, had intended to make the Atlantic crossing direct from Newfoundland to Ireland if possible, or, as an alternative, fly from Newfoundland to London *via* the Azores and Portugal. Major Blake and Captain Macmillan intend to follow the northern route *via* Greenland, Iceland, the Faroe Islands and Scotland, which will considerably shorten the non-stop stages that have to be negotiated. At the time of year when it is expected to cover this part of the flight the weather in the northern latitudes should be favorable, except for local fogs, and by taking this route the strain on the engines should be considerably reduced.

The manner in which it is intended to use the various machines is as follows: One of the DH9's will be used for the journey from London to Calcutta. Here the aviators will change over to *Fairey F. III* seaplane, which will take them around the coast up to Kamchatka and across to Alaska. Here another DH9 will await them, on which the flight across Canada and America to New York will be accomplished. From New York or Newfoundland the last stage, across the northern part of the Atlantic, will be attempted in the F boat.

This, in very brief outline, is the plan of Major Blake and Captain Macmillan, and, barring unforeseen accidents, the scheme promises success. That difficulties will be met and obstacles have to be overcome goes without saying, but there is certainly a very good chance of getting through. All the machines to be used, although of fairly old type, have been proved by years of flying under all sorts of conditions, and should be capable of the stages on which each is being used. The engines also have proved themselves in numerous long-distance flights, and may be expected to uphold the reputation already established. Captain Macmillan is one of our best pilots, and has had experience of a number of different types of machines.

Altogether, the scheme looks promising, and we wish the gallant aviators every success in their very sporting attempt.—*Aerial Age Weekly*, 5 June, 1922.

AIRSHIPS AS AIRPLANE CARRIERS.—In the early days of aeronautical development it was repeatedly suggested to combine the features of airships and airplanes in a composite type which would, in theory at any rate, partake of the advantages of both types and have none of their respective shortcomings. The airship can carry heavy loads over great distances at moderate speeds; the airplane, on the other hand, can carry relatively small loads over rather short distances at the highest speed any vehicle is capable of attaining. Hence it was but natural that attempts should have been made in the past to combine the two types.

The difficulty in doing this has been that in combining the advantages the drawbacks, too, were combined, with no real improvement on either of the fundamental types, because their characteristics were so widely divergent.

By constructing an airship to carry airplanes as separate units, there would seem to be a much better chance of success. In this case each type would retain its technical individuality, and can thus be efficiently designed for its own sphere of work. The idea of the carrier airship is

fundamentally sound, but it involves the solution of some important problems before it can become a reality.

The mechanical details of releasing airplanes from aboard airships, although presenting some novel engineering problems, need not offer serious difficulties. The one really important problem is that of ballast. Many persons apparently assume that weight can be unloaded and loaded on an airship as easily as on a steamship. But a steamship automatically displaces its own weight of water because it floats on the surface, whereas an airship is entirely immersed in the fluid in which it floats. In the latter case there are only three possible methods of maintaining vertical equilibrium, namely: changing the load (as by ballast); changing the temperature, pressure or quantity of gas; and using aerodynamic reactions.

The last method alone is usually ample for taking care of ordinary changes in weight or buoyancy except that due to fuel consumption on a long trip. It is mainly for this latter purpose that various ballast recovery systems are being developed. But all present methods seem to break down when analyzed with respect to counterbalancing the release of a whole squadron of airplanes at once. The *release* can, of course, be handled by letting out gas, but this precludes the possibility of taking the machines on again, because there is no feasible method known of storing or generating gas on board.

But why take the planes on and off at all except for refuelling, repairs and other special purposes? The carrier airship would then be not so much a carrier of airplanes as of fuel, tools, spare parts, ammunition and relief pilots. Such an airship could carry supplies for about five times as many airplanes as it could actually accommodate on board.

For naval purposes a further development suggests itself. If the combination of airplanes and airships is good, that of airplanes, airships *and steamships* should still be better. The steamship is unquestionably the most efficient and economical unit for the mere transporting of loads. But the airship furnishes a more mobile and satisfactory base for many tactical operations.

The airplanes must, of course, do most of the actual fighting, reporting back at frequent intervals to the airship, which in turn will have no trouble in replenishing itself occasionally from the steamship. In fact there may be several airships, each with its airplanes, operating from the one steamship.

The term "aircraft carrier" then broadens in scope to ships of the air as well as ships of the sea. While much of the work along such lines is hidden behind the veil of official reticence, a general discussion of its feasibility should only stimulate activity in both lighter-than-air and heavier-than-air development.—*Aviation*, 15 May, 1922.

ENGINEERING

NAVY ENGINEERING SAVES LARGE SUMS.—The following paper, issued by the bureau of engineering, navy department, ought to furnish food for thought for those persons who accuse the navy of wasting money at times:

Engineering in the navy is so important a function in fitting the navy to perform its mission—its part so closely linked to all other successful naval endeavor—that it appears desirable at this particular time to advise all officers eligible to perform engineering duty of their responsibilities and opportunities.

The hard work of the officers and men afloat that is achieving self-maintenance for the navy does not pass unnoticed, nor does it merely save money. This labor has made possible certain definite improvements in the fleet machinery, and will make possible further improvements so that we have reason to hope for a fleet that is fit and ready for any service.

In October, 1921, notice was received by this bureau that the rate of expenditure of funds during the current fiscal year was in excess of the limit fixed by available naval appropriations. On May 1 an indicated deficit that six months ago was $700,000 had been wiped out and there had become available nearly one million dollars for the purchase of improved engineering materials for the fleet. This million dollars' worth of material is being purchased without creating a deficit.

The expenditures of the fleet for cleaning gear have doubled; at the same time expenditures for lubricating oil, fire brick and packing have decreased so much that the total expenditures for supplies afloat are now about $150,000 a month less than they were a year ago. The indirect saving from cleanliness is obvious.

Where Money Is Saved

For every dollar's worth of material that is worked into a ship by the ship's force, or by the fleet repair force, the charge against the "engineering" appropriation is exactly the cost of the material; when a similar amount of material is worked into the vessel at a navy yard the average cost exceeds $3.50. Thus every time that the fleet has accomplished self-maintenance the cost of this maintenance has been reduced to less than 30 per cent of what it would have been had it been necessary for the work to be accomplished by a navy yard. As a direct result of the success of the fleet in accomplishing self-maintenance and in leaving unnecessary work undone, this bureau has been enabled to institute the following definite improvements to the machinery of the fleet that would otherwise have been left undone for lack of funds:

(a) To purchase new distilling plant of low pressure type which will result in increased capacity and decreased cost of operation. (Fourteen ships.)

(b) To purchase oil purifiers for clearing fuel oil used under the boilers; this will result in more satisfactory oil burning due to less frequent plugging of atomizers, in more reliable operation due to keeping water out of the oil, and in a reduction of the amount of cleaning necessary in the fuel tanks. (Ten ships.)

(c) To purchase electric driven feed pumps for port use, which will increase the economy and reliability of port operation. (Sixteen ships.)

(d) To purchase electric driven fuel oil service pumps for port use, which will increase the economy and reliability of port operation. (Ten ships.)

(e) To modify on all ships all auxiliary turbine exhaust valves to prevent excessive pressures on turbine casings.

(f) To provide additional safe-guards against fuel oil fires by supplying additional distant-controlled valves on all oil-burning ships.

(g) To provide for installing new blower supports for all Terry turbine-driven blowers on destroyers equipped with this type of blower.

(h) To provide fleet tugs with turbine-driven blowers.

(i) To provide retarter for all ships equipped with oil-burning Scotch boilers.

(j) To provide experimental dampers to eliminate vibration in the engines of *S-3* to *S-9*.

(k) To provide improved mufflers for *S-3* to *S-9*.

(l) To provide all submarines with fuel oil meters.

(m) To provide 100-watt "AC" tube set, navy model T.M. These sets are for submarines and increase the range of communication from three to five times. (Sixty ships.)

Radio Stations Improved

In additional to the foregoing considerable improvements to the fleet that the fleet itself has earned and paid for, this bureau has been able to institute improvements to shore radio stations required for communication with the fleet amounting to $143,420.

Among these items are:

(a) To provide special high voltage generator for Anacostia. This is for development work to keep navy to the forefront.

(b) To provide two K. W. 2,000-cycle oscillator for sound research work.

(c) To install radio telephone at Arlington, Va.

The intense competition in fuel economy has had a direct result upon the condition of the machinery of the fleet due to exact operation and careful supervision. This means not only lower costs of upkeep, but greater readiness for service and is another direct dividend to the fleet from its own work.

The future holds much opportunity for further improvements. This improvement can only be made if past performance as regards cost are bettered. At present the fleet is doing better than it has done, but the goal of a machinery plant's entire readiness for any service is very distant. There are now in sight improvements to the machinery of vessels of the fleet that it would cost $16,000,000 to accomplish at navy yards. Until all these improvements (repairs, alterations and additions) have been accomplished our fleet's machinery is not entirely fit and ready for service. If they are accomplished we may expect the port fuel consumption of battleships to average below eight tons, of destroyers below 500 gallons and the fleet radius of action to be increased 50 per cent.

Appropriations Pared Down

The appropriations for the coming year are based upon exact necessities without allowance for improvements, but they are based also upon past performances. Improvements, therefore, in costs of supplies, repairs and operation, all of which depend upon economy and self-maintenance afloat, will make possible in the future, as they have in the past, continued progress in the development of the machinery of the fleet.

Increase in the radius of action of the fleet can be expected only from improvement in the skill, training and zeal of the personnel afloat. Success in this endeavor must be achieved before improved machinery can be paid for. The time will come as a result of the present laudable spirit of service when we will have our fleet's machinery economical, reliable and ready. Every gallon of fuel saved, *i. e.*, not wasted, will contribute towards the fleet's spending more hours underway and hence being more thoroughly trained in maneuvers and gunnery exercises. The value of our navy, in which nearly all operation is secured through machinery, depends, therefore, upon engineering skill, steadily and zealously applied.

The true engineer will always avoid waste and will prevent this waste, so far as practicable, with available means. It makes no difference what the form of the waste. Waste today in any form is not merely an offense against the taxpayer—it limits the possibilities of naval improvement.

Test for the Navy

The present stringency of funds is a test from which the navy must emerge a stronger, hardier and worthier service. Today the honor of the service is more completely in the hands of the naval engineers than in those of any other equal body of men. The lessons learned and the strength acquired through necessity will never be lost.

The officer of the navy is a servant of the Government. He delights in this service and proudly wears its livery, the naval uniform. A dis-

tinguished naval officer of high rank, now on the retired list, recently wrote: "I have known among naval officers, we all have, many high peaks of loyalty and forgetfulness of self in the giving of energy and ability to the service. It is an inspiration to live with fine characters of that sort. They simply go ahead doing their duty without thought of reward or of possible effects of overwork. The idea of devotion to duty as the measure of worth, of worth as the measure of happiness, and of service as the proper aim of each of us, I believe to be true, absolutely. Particularly do I believe that lasting happiness is found only through the medium of unselfish service. The thought of self in service, no matter how big the service, runs counter to nature's laws of compensation. Self-glorification and contentment of spirit are not found on the same trail.

J. K. ROBINSON,
Engineer-in-Chief, U. S. Navy,
Chief of Bureau.

Endorsement

Approved.

The secretary of the navy takes this occasion to congratulate the service on the close co-operation and application to technical efficiency which, as set forth in the attached paper, has directly resulted in making available nearly one million dollars for the purchase of improved engineering material.

It is extremely gratifying to note that the indomitable "will to win" is paramount in the heart of the American naval officer and man, and that obstacles offer but an added incentive for harder work and greater gain.

It is to be hoped that this proof of the dependence of naval readiness for service upon efficient and economical engineering practices in the fleet will inspire the personnel of the navy to maintain the present high standards and to improve them wherever possible.

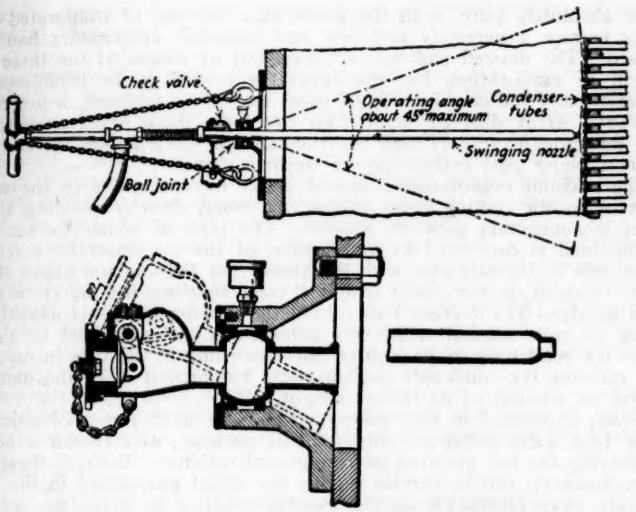
EDWIN DENBY.—*Army and Navy Journal,* 3 June, 1922.

WORTHINGTON CONDENSER-TUBE WASHER.—To meet the need for cleaning out the tubes of surface condensers as often as desired without interfering with their operation, the Worthington Pump and Machinery Corporation, 115 Broadway, New York City, has developed a tube washer consisting of a long water nozzle, or lance, which, after the necessary attachments have been made, may be inserted into the condenser through the different manhole plates and swung around each time so as to force a rapid stream of water through every tube in the condenser.

A section of the condenser with the apparatus in place is shown in the illustration, at the top, and at the bottom is shown one of the attachments that is placed upon each of the manhole plates. This attachment consists of a socket that swivels upon a ball-and-socket joint and through which the lance is inserted with a fairly close sliding fit. The shape of the end of the nozzle is shown at the lower right.

To use the device the operator pushes the long water nozzle into one of the attachments until he can hitch the four chains into the eye-bolts, as shown in the illustration. A spring between the attachment and the connection of the hose to the lance keeps the chains taut and the nozzle in its correct position, with its end very close to the ends of the condenser tubes.

The outer end of the lance is then swung around this way and that so as to force a stream of water (about 60 gallons per minute, 250 pounds pressure) through the different tubes, one after another. The nozzle end does not move in arcs, but is made to move more nearly in a plane surface by the action of the four chains; when the outer end of the pipe is pulled over to one side the chain attached to the eye-bolt on the opposite



A WASHER THAT CLEANS CONDENSER TUBES UNDER FULL VACUUM

The water-jet tube is inserted through attachments in the different manhole plates and swiveled about so as to force a stream of water through each tube in succession.

side pulls it through the socket a little way and so tends to keep the nozzle end fairly close to the tubes.

When the tubes in front of one manhole plate have been cleaned, the lance is withdrawn, and the water in the condenser is prevented from escaping by a check valve shown in the closed position at the bottom of the illustration. A cap on the end of a short chain is then screwed on to make sure that the joint will be tight.

The operation is repeated for each manhole, and the manufacturers claim that about five minutes' work in each position is enough to clean the tubes in front of each plate. Best results, it is said, are obtained when the tubes are washed out daily and when the direction of flow of the washing jet is the same as the flow of circulating water. The apparatus is designed so that it can be attached to the manhole plates or flatheads of condensers already installed.—*Power*, 9 May, 1922.

VACUUM TYPE OF EVAPORATOR BEING EXTENSIVELY USED ON GERMAN SHIPS.—In the operation of steam boiler and engine plants on board of ships there is an unavoidable loss of steam and water during the process of their circulation from the boiler to the engine, through the condenser and the feed water pump back to the boiler. Several years ago these losses were balanced by adding new fresh water from the feed water tanks in the double bottoms, although feed water generators were installed on all steamships. These, however, were only used in cases of emergency when the water from the tanks had been consumed or had become mixed with sea water through leakages. Therefore the economical operation of evaporators was of minor importance.

With the development of the modern steam plant, the introduction of geared turbines and water tube boilers it became necessary for feed water

to be absolutely pure, with the result that the use of evaporated water solely became a necessity and new and economic evaporators had to be devised. The desired end was accomplished by means of the three stage system of evaporation, but the apparatus proved to be troublesome in operation, and the cleaning of the tubes had to be frequent, a process requiring a great deal of labor. To overcome these disadvantages German inventors have perfected the vacuum type of evaporators, and these are now being used extensively on German ships.

The vacuum evaporator is heated either by fuel gases in the smokestack or by the cooling gases of the condenser, thereby avoiding all heat losses in connection with the process. The tank in which the sea water is contained is connected to the vacuum of the condenser by a one-inch or an inch and a half pipe with the result that the vacuum above the sea water is about 90 per cent. Under these conditions the water is evaporated at about 113 degrees Fahrenheit, the heating being accomplished by means of coils around which the smokestack gases are led or through which the condenser cooling water runs according to the type in use. The type utilizing the condenser cooling water has proved to be the most successful on account of its lighter weight.

Steam generated in this manner cannot be used for pre-heating, the boiler feed water being too cold for this purpose; neither can it be used for driving the low pressure part of geared turbines. Both of these processes, however, can be carried out by the steam evaporated in the super-pressure evaporators. It is the general practice to drive the auxiliary engines independently, and their waste steam is more than sufficient for pre-heating the boiler feed water, thus rendering heat from the evaporator unnecessary for this purpose. On the other hand the power which can be drawn from the steam of super-pressure evaporators in low pressure turbines is very small, and is more than counterbalanced by the loss of heat involved in the use of steam for the evaporator.

One of the main advantages of the vacuum steam generator is the fact that it works automatically and requires very little watching. Engineers on freighters do not generally favor steam generating from evaporators because of the work involved and because they prefer to rely upon the feed water in the double bottoms. They contend that they must have enough feed water to enable the ship to reach the next harbor, for an evaporator might break down. Therefore they are inclined to regard the evaporator merely as an apparatus to be used only in case of need. Vacuum evaporators, however, have proved their efficiency on freighters. They are operated in harbor by being made to consume the heat of the condenser into which the waste steam from the winches is led. In most cases sufficient water can be procured in this manner to take the ship to the next port; if not, the process can easily be continued for a short time at sea.

The quantity of feed water necessary to make up the losses in the boiler and the engine is not very large: in the case of freighters equipped with reciprocating engines the quantity is about 2 tons per 1,000 horsepower per day, for combination freight and passenger vessels about 2.5 tons and for passenger liners about 2.8 tons. The amount required for turbine plants, which use less steam, is correspondingly smaller.

In the case of the larger passenger liners with high engine power it is uneconomical to carry feed water for the entire trip in the double bottoms, as this would involve a considerable loss of deadweight capacity. It would be much cheaper for such vessels to carry vacuum steam generators of ample size, and reserve generators of the same or another type for use in the event of a breakdown of the main generator. The use of these evaporators has shown that feed water can be procured more cheaply than in harbors, and moreover, the water has the advantage of being free from impurities and gases, a factor of the highest importance

to the efficiency of the boiler, especially on oil-burning ships.—*Nautical Gazette*, 13 May, 1922.

MANŒUVRING OF SHIPS.—This paper deals with the research on this subject which is being carried out by the authors at the National Physical Laboratory. The research is intended ultimately to cover various types of ship and rudder. The work so far completed has been confined to the tests of "unbalanced" or "ordinary" rudders, either in open water behind a flat plate, or behind an ordinary ship model having a single screw propeller, at load draught, the ship being of the type capable of working at about 10 to 12 knots on 400 feet length.

Three rudders, *B*, *C* and *D*, of the same immersed area but of different outline (see Fig. 1) have been tested both in open water behind a thin fore-and-aft flat plate and in the ordinary position behind the rudder-post of a model fitted with a single screw. A fourth rudder, *A*, was also tested, this differing from *D* in being 21.2 per cent longer. A fifth one, marked *E*, was also tested behind the fin plate to obtain exaggerated surface effect. This had the same area as *B*, *C* and *D*.

The experiments have shown:

(1) Under *similar* conditions the torques on the stock of an ordinary unbalanced rudder vary as the square of the speed, and the dissimilar

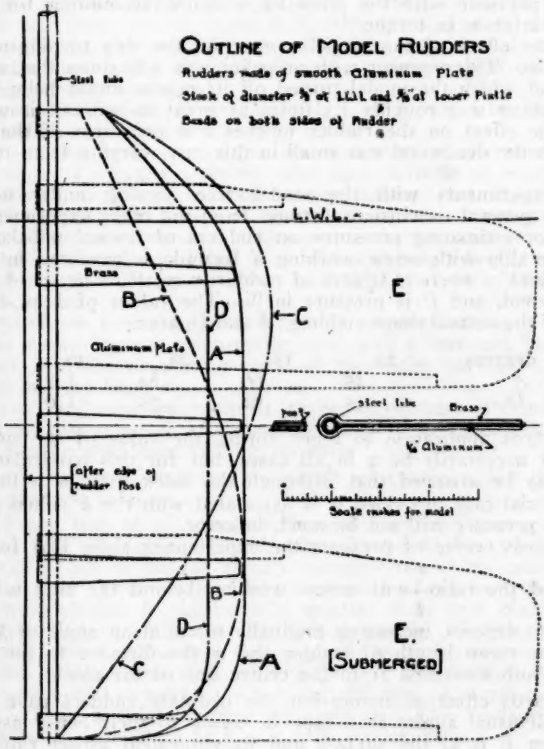


FIG. 1.

conditions represented by varying speed of any ship can only be met by means of a coefficient determined by experiment. The results obtained on a model at any speed can be applied to a ship at the corresponding speed by assuming that the torque varies as the product $A\ V^2\ l$, where A is the area of the rudder, V is the speed, and l the mean length of the rudder measured from the centre-line of the stock.

(2) Change in shape of rudder keeping the area constant had very little effect on its "ship turning-moment," but as the least moment on the rudder-stock was obtained with a rudder of normal type this appears to be the best shape for vessels of the type tested. Increasing area of rudder increases the ship turning-moment, but to a smaller extent than the increase in area. The torque on the stock increases directly as the product of area and length of rudder, so that a deep rudder is better than a long one.

(3) The forward movement of the water at the stern in a vessel of .78 prismatic coefficient reduced the torques and pressures on the rudder in open water by 50 per cent; but with the propeller working in front of it, at a normal true slip of about 40 per cent (7 per cent taken on the ship's speed), the torques and pressures are increased by a little more than this amount, so that actually the torques exceed those in open water without screw by a slight amount. There is a little movement of the centre of pressure with the propeller working, accounting for about 10 per cent variation in torque.

(4) The effect of the propeller race on the ship turning-moment is considerable. This moment with propeller was 1.85 times that without it. The rate at which the model turned off its course under helm with propeller working was roughly 1.3 times as great as without it working.

(5) The effect on the rudder torques and pressures of the propeller aperture in the deadwood was small in this case, varying from 10 to 4 per cent.

(6) Experiments with the model free, yawing under helm, supported the general conclusions formed from the other experimental work.

(7) For estimating pressures on rudders of normal unbalanced type behind the ship with screw working a formula is proposed in the usual form $P=kAV$, where A is area of rudder in sq. ft., V is speed of ship in ft. per second, and P is pressure in lb. The values of k as determined for two of the normal shape rudders, A and D, are:

Angle, degrees	10	15	20	30	35
Rudder A	.45	.66	.84	1.1	1.24
Rudder D	.45	.61	.75	1.0	1.13

As regards application to other forms, the value of the speed index would not necessarily be 2 in all cases, but for this particular class of ship it may be assumed that, although the index may be a little wrong in any special case, provided it is associated with the k values given, the calculated pressure will not be much in error.

As regards centre of pressure the experiments show that for all rudders tested the ratio $\frac{x}{l}$—with screw working behind the ship is .34 at an angle of 10 degrees, increasing gradually to .46 at an angle of 35 degrees, l being the mean length of rudder and x the distance to the centre of pressure, both measured from the centre line of the stock.

As regards effect of immersion, the ordinary rudders gave better results at all usual angles than type E, owing to their better aspect ratio. Even when E is at the surface and its equivalent aspect ratio doubled, although much better than when submerged, it is still worse than the others. This rudder shows best at large angles when fully submerged,

and worst at the surface at high speeds, when the speed for maximum wave-making has been passed.

(8) A few experiments made with the screw backing, the model moving ahead, showed that the torque on the stock was much smaller than for normal conditions; but with the model moving stern first, with or without the screw backing, the torques on the stock were higher than for normal ahead conditions at the same speed, the increase varying from over 100 per cent at small angles to a few per cent at 40 degrees of helm; but allowing for the difference between practical ahead and astern speeds, the greatest torque on the stock is developed going ahead with large helm.—*The Shipbuilder,* Annual Number, 1922.

ALCOHOL FOR INTERNAL COMBUSTION ENGINES.—It was decided by the Empire Motor Fuels committee that a comprehensive and complete scientific investigation should be made of the behavior of alcohol in internal combustion engines, and that a complete range of experiments should be carried out with 95 volumes per cent alcohol, as this was the strongest alcohol produced in commerce by the patent still. Through the kindness of the Anglo-Asiatic Petroleum company the committee was allowed to make use of the Ricardo variable compression engine which had been designed and built for that company. The Government authorities gave permission for the experiments to be carried out with pure alcohol, so that there should be no difficulties introduced in this fundamental work by the presence of denaturants. In these and all other tests the committee has readily obtained the willing co-operation of the Government departments concerned.

The experiments which it was decided to carry out with 95 volumes per cent alcohol were divided into four series:

Series 1.—Tests for power output and consumption over the complete available range of mixture strength with open throttle at four different piston speeds from 800 ft. to 2000 ft. per minute, and at compression ratios of 3.8 to 1 and 7 to 1 with constant heat to the carburetor.

Series 2.—Tests of power and efficiency over complete range of mixture strength at 0.8, 0.6 and 0.4 of full load with piston speeds of 1200 ft. and 2000 ft. per minute and a compression ratio of 5 to 1, with constant heat to the carburetor.

Series 3.—Tests over complete range of mixture strength at piston speed 2,000 ft. per minute, compression ratio 5 to 1, constant heat to carburetor, but with the circulating water at the outlet varied from 30 degrees to 90 degrees Cent.

Series 4.—Tests over the complete range of mixture strength at 2000 ft. per minute piston speed, at a compression of 5 to 1, varying the heat input to the carburetor from nil to 2,000 watts.

This work has entailed many thousands of readings, but the results are of the greatest value.

It was found that at all speeds both with high and low compression the thermal efficiency obtained with alcohol was higher than that obtainable with petrol or benzol at any compression which could be employed with them. Even at the low compression of 3.8 to 1, the thermal efficiency with alcohol is substantially greater than that obtained with petrol under similar conditions. In both cases the efficiency is almost independent of speed. The heat delivered to the circulating water is less in proportion with alcohol than with petrol. It was further found that compared with petrol or benzol the thermal efficiency obtained with alcohol was equally high at high or low compression. The tendency to pre-ignition began to be evident at 7 to 1 compression ratio.

Owing to the lower heat value of alcohol, the fuel consumption is much higher than is the case with petrol, in spite of the higher thermal

efficiency, if they are used at the same compression, but the fuel consumption can be reduced much further in the case of alcohol than in the case of petrol by increase of compression ratio. The throttle tests (Series 2) have shown that the behavior of alcohol and petrol under variations of throttle conditions was identical.

The influence of jacket water temperature was investigated (Series 3), and showed that the power output from the engine was slightly diminished with increasing jacket temperature. The efficiency also fell slightly, as is the case with all other volatile fuels investigated. The reputed increased power obtainable with alcohol engines with hot water jacket is probably much more due to the diminished piston friction in the warm cylinder than to any other cause.

The experiments in Series 4 have shown that the maximum output from the engine is obtained when no heat is supplied to the ingoing air, but the thermal efficiency is slightly increased with increase of heat to the carburetor.

It has been proved that under all conditions of compression speed or throttle alcohol-driven engines run more sweetly and more smoothly than when running on petrol. Detonation never occurred under any compression employed, but at 7 to 1 compression, corresponding to a pressure of 185 pounds per square inch, there was a tendency to pre-ignition; 6½ to 1 is probably the maximum compression to be aimed for.

There has been no evidence whatever of any corrosion of valves.

It must be remembered that these experiments have been carried out on a single-cylinder engine, and that in practice troubles and difficulties introduced by induction manifolds may render it desirable to sacrifice efficiency in some directions to gain flexibility and acceleration. Nevertheless, the series of experiments which have been carried out have led to the accumulation of the most valuable fundamental facts and figures which must be of the greatest value to the industry in the near future. It was decided by the committee that further experiments should be carried out on similar lines to those above referred to, but with alcohol at 99 and 90 volumes per cent strength. The results obtained with these fuels substantiated the earlier work and proved that the mean effective pressure increases as the water content is increased, so long as the whole of the fuel and water is completely evaporated before the end of the compression stroke. The power output was increased slightly even with the 90 volumes per cent alcohol. The behaviour of the varying amounts of water was studied over compression ranging from 3.8 to 1 to 7 to 1, and it was proved that the presence of water in all cases increases the maximum power output and reduces the heat flow through the cylinder walls. In high compression engines there is a substantial advantage in using alcohol containing a reasonable amount of water.

It has definitely been proved:

(1) that alcohol can be used from the low compression employed on paraffin engines up to a far higher compression that can be used on any petrol engine;

(2) that the thermal efficiency obtainable with alcohol is higher than with petrol or benzol;

(3) that under all conditions of throttle or mixture alcohol requires the spark more advanced than is the case with petrol or benzol, and much more advanced with weak mixtures;

(4) that there was no evidence at any piston speed attained in the engine that the rate of combustion of alcohol under the conditions obtaining was too slow to obtain the maximum effect;

(5) that detonation does not occur at compressions up to 8 to 1, and pre-ignition does not occur at 6 to 1, even when running for long periods at the highest possible power output of the engine;

(6) that there was no evidence whatever of corrosion in the engine;
(7) that the power output and efficiency are increased by low temperature of the circulating water;
(8) that supplying heat to the carburetor reduced the power output but slightly increases the thermal efficiency;
(9) that increase in the water content up to 10 volumes per cent is an advantage, particularly in very high compression engines.

A new series of experiments is now in hand with a view to investigating the influence of ether on alcohol, and the influence of alcohol on petrol, benzol, paraffin, and the like. It is believed that this work will prove of considerable value to the motor industry, as it is probable that the first introduction of alcohol on any scale as a motor fuel will be in the form of an admixture of it with other ingredients.—*The Engineer*, 12 May, 1922.

NON-CORRODIBLE IRON AND STEEL.—A paper of great importance to marine engineering, "Corrosion of Ferrous Metals," was read a short time ago before the Institution of Civil Engineers by Sir Robert Hadfield. In 1916 the institution formed a committee to study the corrosive action of sea water on structures in general, and Sir Robert Hadfield was consulted as to the best methods of investigating the results in connection with the ferrous metals. Acting upon his advice, 14 types of ferrous material, both iron and steel, were examined, the former consisting of wrought iron, Swedish charcoal iron, "Armco" iron, cold-blast cast iron, and hot-blast cast iron. The steel specimens selected were mild steel with low manganese and high sulphur and phosphorus content, mild steel with 0.7 per cent manganese, medium carbon steel with low sulphur and phosphorus, carbon steel with 0.4 per cent carbon, mild steel with 0.5 per cent copper, mild steel with 2 per cent copper, nickel steel with 3.5 per cent nickel, nickel steel with 36 per cent nickel, and rustless chromium steel (13½ per cent chromium). The committee fixed a standard size, 24 inches long, 3 inches wide, and ½ inch thick, for the samples, and in the course of the investigations, 1,330 separate specimens have been prepared, mostly in the "as rolled" condition, but in many cases also heat treated. An elaborate series of investigations as to the properties of 182 of the test pieces have been carried out in Sir Robert Hadfield's laboratory, including complete chemical analysis, Brinell hardness number, photomicrographs of longitudinal and transverse sections, tensile tests, and shock tests. Sets of the test bars are then to be immersed in the sea for a long period, at the end of which they will be examined in the same exhaustive manner to ascertain the extent of the corrosion and the difference caused in the various properties.

A remarkable feature of research work on alloys is the effect that even traces of one metal will have in altering the properties of the final alloy. Thus, for example, in connection with the corrosion of ferrous metals by sea water, the addition to steel of small amounts of copper causes a pronounced difference by increasing the resistance to corrosion, a fact for which there does not seem to be any adequate explanation.

Sufficient work has, however, been done of the subject of alloys in the last few years to warrant the expectation that we shall in the near future be able to produce non-corrosive iron, steel and other metals at a price capable of being used in bulk. It is difficult to realize what the corrosion of metals is costing the world, not only in damage and loss in the actual metal, but also in the continual costly painting that is necessary, and the shipping industry suffers more in this respect than any other.

Sir Robert Hadfield gives some arresting figures in his paper. It is estimated that the total steel production of the world from 1860 to 1920 has been 1,860,000,000 tons, of which about 660,000,000 tons have been

destroyed by rusting whilst actually in use. In the year 1920, for example, the loss throughout the world was about 29,000,000 tons, and, taking the value of steel as, say, £20 per ton, the total loss to the world, including all the money spent on paint-work or other protective devices, was about £700,000,000. If ships can be made of non-corrodible metal throughout, it will be a revolution in marine engineering, the beneficial effect of which it is difficult to realise.—*The Marine Engineer and Naval Architect*, May, 1922.

NAVIGATION AND RADIO

MAPS AND NAVIGATION METHODS. BY A. DUVAL.*—Before undertaking any voyage, however short, the aerial navigator provides himself with the necessary maps. This is an easy matter in our country, where there is a wide choice among the various maps published by the geographic section of the army, the department of the interior and the Aero Club.

When it is a question of a trip into a foreign country, the case is no longer the same. In some countries the only existing maps are incorrect or poorly edited, while in others they are comparable with ours, but French navigators, not being accustomed to their scales, nor to their colors, nor to their special manner of presentation, do not find them convenient. Reciprocally, foreigners experience the same inconvenience in using our maps. The most commonly used map is drawn on the scale of 1:200,000. This gives the most details of interest to the aviator, without taking too much paper. The 1:1,000,000 scale is useful for long voyages. It is always best to carry the corresponding maps on the 1:200,000 scale, for the aerial navigator sometimes has occasion to identify details not shown on the 1:1,000,000 map.

These two maps are not specially made for aviators. It seems therefore that the solution of the problem has progressed hardly any since Mr. Lallemand, member of the Institute, asked for the creation of aviation maps. This delay is explained by the fact that during the war the existing maps (1:200,000 of the geographic section of the army, and 1:126,720 of the ordnance survey) were satisfactory to the aviators of the Allies, who flew in restricted sectors and seldom made long voyages.

Now the requirements of civil aeronautics, the chief object of which is to make voyages, are different and depend on aviation maps. This fact did not escape the attention of the experts who drew up the international agreement of October 13, 1919, containing regulations for aerial navigation. Annex F, of this agreement or convention, made provision for various international aviation maps, which the contracting countries will publish within a few years. Already three of the most enterprising nations have agreed on the details of execution, as we shall see further along.

Anyway, it is not out of place to call attention to the scope of the task undertaken, as well as to the value of the preliminary work accomplished since 1919. If the aviators, who are wanting aviation maps worthy of the name, had any idea of the work accomplished, their very natural impatience would be less prompt to manifest itself.

Under the respective designations of normal maps and general maps, the convention established two types of international aviation maps. In principle, they must be made according to the rules adopted for the 1:1,000,000 map of the world, with the metric system of measurements. Each country, however, has the privilege to *add* its own units of measurement to the maps it publishes.

After discussion during the English-French-Belgian conferences of 1920 and 1921, the details of the conventional symbols were fixed. Since their exposition lies outside the scope of this article, we will confine ourselves to a general description of the two kinds of maps provided for.

* From *Premier Congrès International de la Navigation Aérienne*, pp. 150-155, Paris, November, 1921.

General Maps.—The general map is made according to Mercator's projection, one degree of longitude being represented by a length of three centimeters, which gives, in our latitude, an average scale of about 1:2,000,000. Each folio contains a complete number of sections of the map of the world on the 1:1,000,000 scale, which is generally nine for latitudes below 60°, six and even three for higher latitudes. Each side of each sheet covers 1° in latitude by 2° in longitude. There is a common portion on adjacent sheets, which facilitates the passage from one sheet to the next.

The relief is indicated by hypsometric tints supplemented by altimetric figures and, where there is occasion for it, by a slight shading. This method of representing the relief is in conformity with the 1:1,000,000 map of the world. It enables the aviator to choose instantly, without risk, the altitude of safety, in case of poor visibility. Any representation of relief, accomplished simply by means of shading and altitude figures, does not offer this advantage, since the navigator must read all the altitudes of a region in order to determine the altitude of safety. He runs the risk of overlooking that of the summit, against which he is in danger of crashing. The necessity of judging the altitude of the whole region led to the use of hypsometric colors for the general map. It is omitted on the normal maps, where each section bears on its margin the altitude of the highest point and of the lowest point in the region represented. The relief of the normal map is also shown by shading.

Lastly, general maps are only provided for continents. Aviation maps are not necessary, in fact, for the oceans, for which the aeronaut will use marine maps based on Mercator's projection.

Normal Maps.—These are published on the scale of 1:200,000. The kind of projection is not stipulated. This is because, on the one hand, the various projections differ but little on this scale and because, on the other hand, of the great advantage of being able to make use of much existing cartographic material.

Each section of the normal map embraces 1° in longitude and 1° in latitude. They will doubtless overlap one another by several kilometers. The relief is indicated by shading, supplemented by altimetric figures.

Miscellaneous Maps.—The object of the convention was to create a set of identical aeronautic maps for the whole globe. Aside from these standard maps, the aerial navigator may use any others. Let us note, in passing, the 1:200,000 map of Capt. Hebrard and Lieut. Robbe, on which the roads stand out light against a dark background. The advantages of this method will be manifest, when night flights become common.

Maps are indispensable for the aviator. Their conception, however, depends on the methods employed in aerial navigation, which we will now endeavor to set forth.

"To navigate is to go from one point to another by the shortest and easiest route." This applies to both water and aircraft.

Aerial navigation, although freely accomplished in three dimensions (with certain restrictions in the vertical direction) is in all points comparable with maritime navigation. On the contrary, it is not comparable with the means of land transportation.

In fact, there are two methods of navigating an aircraft:

1. To fly with continuous reference to landmarks;[1]
2. To take a direct route by the compass, with only occasional reference to the ground for determining the position of the aircraft.

[1] Some authors make a distinction between following a continuous reference line (highway or railroad) and flying from one reference point to another by comparing the ground and the map. This is a distinction with a difference, since in cloudy weather they lead to the same result, flight near the ground.

The former method, which is chronologically older, is still commonly employed. Although comprehensible in the beginnings of aviation, when only the pilot was on board and the voyages were of short duration, it is now an anachronism. To be compelled to follow a railway or a river is a loss of time. This method is, moreover, not very safe, for as soon as the pilot loses this "thread of Ariadne," he is lost. Errors have been frequent at cross-roads and junctions. Lastly, it is well to note the danger resulting from this practice. On a given aerial route, all the pilots would follow, in cloudy weather, exactly the same landmarks, thus creating great risk of collisions.

The second method, successfully employed on aeroplanes and airships by several crews, has stood the test for centuries in all navies. It is therefore no novelty, but merely an adaptation. By means of the compass, the pilot steers the aircraft in a constant direction with reference to the meridian. The path thus described is a loxodromic or rhumb line.

Hence, to steer by the compass is to describe a loxodromic curve. The pilot only needs to choose the one which connects his starting point with his destination, and then to make sure from time to time that he has not departed from it and, lastly, to verify his speed.

The use of the compass renders it possible to follow the most direct route between two points and especially to lose sight of land without inconvenience, for a certain length of time. At any instant, the navigator can determine his position by "dead reckoning," with the aid of his absolute speed and the time elapsed.

The accuracy of this method depends on the pilot's skill in using his compass and on the exactness of his knowledge of the data employed, namely, the angle of the route followed and the absolute speed. The route angle is the angle formed with the meridian by the loxodromic trajectory described on the earth by the aircraft which is steered with the aid of the compass.

As often as possible, this dead reckoning will be verified by observations of terrestrial or celestial reference points, or other method (radiogoniometry, etc.).

Usually the wind causes the aeroplane to drift (uniformly, if the wind is regular). The angle between the axis of the aircraft called the course, and the route actually followed is the angle of drift. The pilot must therefore endeavor to determine the course to be adopted so that the drift will cause him to follow the loxodromic line traced on the map. Practically, for holding the aircraft on this course, the pilot must determine opposite what graduation of the compass rose he must hold the reference mark which indicates the position of the axis of the aeroplane. The compass course is obtained by correcting the given course by the angle of "variation." This variation is the algebraic sum of the magnetic declination (angle formed, at any given place, between the geographic and magnetic meridians) and the deflection caused by the iron of the aircraft, which affects the magnetized compass needle. The declination is always exactly known. As to the deflection, an endeavor should be made to eliminate this once for all by "compensation," the explanation of which lies outside the scope of the present article. It is a very simple and practical operation. When properly executed, the residual deflection is very small (1° to 2°) and the directive force of the compass remains constant for different courses.

The only difficulty encountered in following a loxodromic or rhumb line is therefore the determination of the angle of drift. By means of aerological soundings, this is easily determined before starting. The data for calculating the course then remain exact so long as the wind does not vary. If the wind is found to change, it becomes necessary to change the course steered or be driven off the true course. During the

voyage, the navigator must employ one of the two following methods for determining the drift.

1. Determination, on the map, of two successive positions of the aircraft and of the exact route followed between these positions.

2. Instantaneous measurement of the drift by the observation of some point on the earth.

The first method utilizes what some call "navigation by observation," in which the navigator steers by calculation, which he rectifies by every observation made. He thus describes a series of loxodromic lines each one starting from the last point observed.

The second method of measuring the drift necessitates a brief view of the earth, without its being necessary, however, to identify any given reference point. It consists in measuring the angle formed by the apparent motion of the reference point and the course of the aircraft. This measurement can be made, even when the reference point does not pass directly under the aircraft. The S. T. Ae. (Technical Section of Aeronautics) drift-meter and the Le Prieur "navigraph" are based on this principle. Moreover, the results are faithfully preserved, which constitutes a great advantage, since two successive drift measurements with different courses give the magnitude and direction of the wind.

The absolute speed is measured; either by noting the time taken to traverse the distance between two observed points, which are shown on the map; or instantaneously by making measurements with reference to a single point, which does not need to be identified.

For utilizing the latter method, we may employ the navigraph, the S.T.Ae. drift-meter, or the Le Prieur "cinemograph."

In the S.T.Ae. drift-meter, there are two sighting wires, adjustable in altitude, which intercept a base of 500 km. on the ground. The navigator sights a reference point and measures with a chronograph the time of passage from one wire to the other. An abacus gives the absolute speed in km/hr.

In the Le Prieur cinemograph, the sighting is done with the aid of a slide carrying a stylus which traces a line on a paper moving vertically with a uniform speed. These combined uniform motions give a straight line, the inclination of which is a function of the altitude and of the speed. The errors due to changes in the trim of the aircraft are eliminated by the fact of the graphic inscription.

In the navigraph, the absolute speed is obtained by the automatic production of the triangle of velocities, of which the sides "air speed" and "wind" are known, as also the angle of drift.

Observation Point.—This can be obtained by watching the ground. The navigator either identifies some reference point under him or determines his position with the aid of distant reference points.

When the ground is not visible, the observation point is found by observing the stars, according to methods similar to those employed at sea. Unfortunately, the mariner's sextant is not utilizable on aircraft and no other instrument has thus far afforded any practical solution of the problem. For want of an astronomical point, the aerial navigator can utilize radiogoniometry.

The preceding exposition shows that loxodromy is the basis of aerial navigation. The ideal map for aerial navigation is therefore the one on which all the loxodromes are represented by straight lines and their angles with the meridians. Only Mercator's projection will answer these requirements. Its use for general aeronautic maps is therefore fully justified.

As regards utilizable routes in aerial navigation, we have purposely omitted orthodromy (sailing on the arc of a great circle). The arc of a great circle is in fact the shortest way between any two points on the earth's surface and would therefore seem preferable to loxodromy. This

advantage is, however, only theoretical, since for all points less than 1,000 km. (622 miles) the difference between the orthodrome and loxodrome is negligible (about 1/300). Now the stops, the obligatory points for crossing frontiers, and natural obstacles impose an itinerary, whose sections rarely attain 1,000 km. These sections are therefore loxodromes.

There remains the employment of orthodromy on very long trips. Here again flight on the arc of a great cricle does not make good its promises. If the points of departure and arrival are on the same parallel of latitude, the vertex or culminating point of the curve is near the pole and hence climatic considerations prevent the utilization of the most important part of the ideal curve. If the points of departure and arrival are almost on the same meridian or near the equator, the orthodrome and loxodrome differ but little. It should be noted, moreover, that the only method for describing a great circle consists in resolving it into a series of successive loxodromes of about 1,000 km. which are followed by means of a compass.

The arc of a great circle therefore serves to determine an itinerary. There is no need of special maps for this purpose, since Mr. Favé, a member of the institute, has invented a rapid and simple method of tracing the arc of a great circle on a Mercator map. The employment of the Favé abacus enables the aerial navigator to determine instantly and accurately the points through which an arc of a great circle passes by simply moving over the map a transparent sheet on which is traced a whole series of curves representing the projection of various great circles whose vertices are on any given meridian.

In conclusion, we may say that, on the one hand, the question of aeronautic maps is progressive and is following its normal course; while, on the other hand, the empirical methods of aerial navigation thus far employed are retrogressive, slow and dangerous and should be replaced by scientific methods of navigation, based on loxodromy and the use of the compass.

(Translated by the national advisory committee for aeronautics.)—*Aerial Age Weekly*, 8 May, 1922.

WEIGHT INSTRUMENT FOR MEASURING OCEAN DEPTHS IS VERY RELIABLE.—Rapid development has been made in the methods of utilizing sound under water for ascertaining the depth of the ocean. One of the latest and most practical applications of the principle is embodied in an instrument known as the weight.

The action of this device is based on the theory that a solid body travels through water at a regular speed. It is an established fact that if a metal ball is dropped into the water from a height of approximately six yards above the surface of the water, it reaches the water at a speed of about ten yards per second. When the balls enters the water the speed is reduced, and when less than half a yard below the surface it assumes a steady speed which is maintained until the bottom of the ocean is reached.

The weight consists of a metal ball to which a small bomb is attached. The apparatus is thrown into the ocean and when the bottom is reached the bomb explodes. The sound of the explosion is received on board the vessel by the usual underwater sound receivers now installed on a large number of ships. The time from the instant the ball touches the surface of the water to the moment when the sound of the explosion is heard is measured by a stop-watch and the depth of the ocean calculated. For example, assume that the metal ball travels through the water at a rate of two yards per second, and the depth of water is twenty yards, ten seconds would elapse between the time the ball struck the water and the explosion is heard. It can readily be seen that the number of seconds thus recorded by the stop-watch multiplied by two will give the depth of the ocean in yards.

The great advantage of this apparatus is that it can be operated by the officer on the bridge without the aid of any member of the crew. Furthermore, it is not necessary to reduce the speed of the ship to take soundings unless the water is very deep.

In the use of the various instruments which are based on the principle of utilizing sound under water as a means of ascertaining the depth of the ocean it should be remembered that water as a sound conveyor does not always act in the same manner. It often happens that in sound expansion and sound limit, considerable fluctuations are to be recorded. These fluctuations are due to the difference in temperature between the water near the surface and the water at the bottom, and also to the varying percentage of salt in the ocean at different depths.—*Nautical Gazette*, 13 May, 1922.

SECRECY OF RADIO MESSAGES PROMISED BY JOHN H. HAMMOND, JR.—John Hays Hammond, Jr.,. apparently has revolutionized radio communication by a new invention. He has perfected a comparatively simple apparatus to prevent any station from taking messages except those for which it is intended.

The same wave can be made to carry several messages at the same time, and, further, it is stated, both voice and code may be transmitted.

The new apparatus will allow a far greater number of stations to communicate over a limited number of wavelengths. Accidental interference from other stations is greatly reduced. Efficiency is increased. Atmospheric electricity, or static, is diminished in its effect upon the new system to such extent that the system may be operated under conditions when the standard radio apparatus cannot successfully receive.

Mr. Hammond's statement declares that he has been at work upon these problems for the past fourteen years. A demonstration was given today before officials and experts of one of the leading American radio companies, and Mr. Hammond says the United States navy and war departments have given his latest discoveries exhaustive tests with success.

The system, it is declared, embodies a direct and simple means of insuring privacy, and it will be practically impossible under ordinary conditions for any other than the proper receiving station to hear anything but a jumble.

The treasury department was authorized in 1916 to set aside an appropriation of $750,000 to acquire the patent rights of John Hays Hammond, Jr., in order to have the exclusive use of his researches and inventions in the line of the radio dynamic control of torpedoes. Military authorities spent a large amount of time in furthering the idea until last summer, when the chief of the coast artillery, owing to the developments of bombing from aeroplanes, decided to recommend its abandonment.

It is stated that, because of the new device, the navy has asked the Senate sub-committee considering the army appropriation bill to strike out the requirement that the $750,000 appropriation made in 1916 to acquire the special rights of John Hays Hammond, Jr., be returned to the Treasury.—*Aerial Age Weekly*, 29 May, 1922.

RADIO TO JOIN FIVE COUNTRIES.—On returning from the International Radio Conference yesterday Edward J. Nally disclosed the fact that a new radio service that will link five nations together was one result of the gatherings in Cannes, Paris, and later in London.

The conferences were carried on under the auspices of the Commercial Radio International Committee, and this agreement has been made between representatives of companies of England, France, Germany, United States and South America.

The new circuit will be operated in New York, Paris, London, Berlin and Buenos Aires. Mr. Nally, who is the president of the Radio Corporation of America, came back on the steamship *Homeric* after several weeks abroad attending the conferences. He told *The Evening World* that many important questions affecting the development and operation of wireless were considered and satisfactorily settled; in particular, the questions dealing with the extension and development of world-wide telegraph and telephonic communication.

The first of these new international services will be in Argentina, where a super-powered station is now in course of construction and which will be completed soon. It will be located near Buenos Aires and will be capable of transmitting and receiving simultaneously with the stations to be erected in New York, Paris, London, and Berlin.

Another conference will be held by technical experts of committee in Berlin late in June to conclude the world-wide connection of other countries by wireless.

Mr. Nally said that the people in Europe are intensely interested in the development of the radiophone and broadcasting service in the United States. Owing to existing laws their many difficulties will have to be overcome by several of the governments before broadcasting is done on the same broad plane as in the United States.—*Aerial Age Weekly*, 22 May, 1922.

HIGH-POWER VACUUM TUBES.—In connection with Great Britain's imperial chain—a world-wide radio system that has been under way for a long time—the technical committee recommended the use of high-powered tube installations. A considerable amount of very valuable work has been carried out in the past year by the British admiralty, working in conjunction with the Mullard tube builders. Much progress has been made in the construction of silica tubes, which have now been made in ten-kilowatt sizes. The result of this work will undoubtedly be seen in the forthcoming year. We may expect a large number of land stations operating on valves of large power.—*Aerial Age Weekly*, 1 May, 1922.

ORDNANCE

PROJECTILE DIMENSION TOLERANCES.—For some time experiments have been under way under the auspices of the army ordnance department in connection with the effect of tolerances on projectile dimensions, with a view of securing increased accuracy and at the same time to keep the dimensions within limits that may reasonably be prescribed in manufacturing operations. If two projectiles are to range the same, they in general should have the same size, shape, and distribution of weight. To insure a reasonable degree of uniformity in this respect, tolerances are placed on the more important dimensions shown on projectile drawings. For example, in the case of a 155-mm. shell, the normal over-all length of the unfused projectile is 22.7 inches, and the tolerances on the drawing indicate that any shells that do not differ in this respect by more than 0.18 inch will be acceptable. Aside from dimensions affecting threads, there are shown on the drawing of this projectile tolerances on nine dimensions ranging in magnitude from plus or minus five-thousandths of an inch to eighteen hundredths of an inch. The larger the tolerances the cheaper it is to manufacture the shell, but, on the other hand, one would expect that the smaller they are the more accurate would be the ranging of the projectiles.

The problem of deciding exactly what these tolerances should be is one of the most important and difficult of the projectile designer. Until recently there have been almost no data available on which to base such a

decision, and consequently up to this time the magnitude of the tolerances has been governed almost entirely by precedent and tradition. At present, however, as a result of a 1,500-round range-firing program for the 155-mm. G. P. F. gun, which just has been completed, the ordnance department is in possession of a certain amount of information concerning the effect of changes in various dimensions on range, and for the first time it is able to base its decision in this regard on rational grounds.

The program is regarded, however, as merely a beginning, for the results obtained from it are applicable only to a projectile of a given size and shape when fired with a given muzzle velocity at a given elevation. To extend this program by range firings to cover the multitude of combinations of shapes, sizes, and muzzle velocities would involve an enormous expenditure of ammunition. Nevertheless, as a result of an extensive program of air-resistance firings now commencing, it is believed that useful data on the subject will be accumulated at much less expense.

There undoubtedly are some projectile shapes that are much more sensitive to slight changes in dimension than others. In its future design work the ordnance department proposes to make a study of the problem from this point of view, with the object of selecting those shapes that will permit the greatest tolerances on dimensions for a given effect on range.—*Army and Navy Register*, 20 May, 1922.

MISCELLANEOUS

REVOLUTIONARY CHANGE IMPENDING FROM STEAM-POWERED TO OIL-DRIVEN SHIPS.*—A revolution of a technical nature, whose political and economic effect on the future cannot be overestimated, is at present taking place in the world's shipping. During the last few years, extraordinary progress has been made in the substitution of oil fuel and oil-driven motors for steam power generated by coal. The revolution seems likely to be more far-reaching in its effects than the last great revolution in shipping, when sailing vessels were replaced by steamships.

War Hastened Change

When the war broke out oil-driven shipping was only in its infancy. Coal fuel was comparatively cheap and the fuel supply in all the seaports of the world was excellently regulated and secured. There seemed, therefore, no reason for abandoning coal fuel in favor of a fuel which had only been tried in minor and coastal vessels. The great and long enduring coal shortage of the war and post-war days, however, brought about a "flight from coal" to an extent and with a rapidity which ten years ago would have been deemed impossible.

Just as the war gave a new impetus to sailing ships and their construction so, too, to an incomparably greater extent oil-driven shipping was encouraged by the coal shortage and the high price of coal. As matters stand today, the steamship, as compared with large vessels driven by oil fuel or oil motors, appears, all things being equal, old-fashioned and is likely to be regarded in the near future as out of date. Comparative statistics obtained in 1921 show to a surprising extent that oil fuel is marching forward victoriously, rapidly and unceasingly, and that coal fuel is losing in importance with unexpected rapidity, especially as, from an economic standpoint, coal fuel is far inferior to oil.

The extent to which coal is being replaced by oil can be gauged from the fact that there were 2,336 oil fuel burning, seagoing vessels of 12,800,000 gross tons in 1920 as against 364 such ships of 1,300,000 tons in 1915.

* Extracts from an article appearing in the *Technik und Wirtschaft* as summarized by *The Economic Review*.

The use of oil for driving Diesel motors, which is a far more economical method of using oil fuel, has not as yet attained great dimensions, and as far as ocean-going vessels are concerned, is in its early stages. But in a few years' time it may well have surpassed in importance the employment of oil for firing. To show the significance of the Diesel motor for existing and future marine shipping, the following figures may be given.

The first practicable Diesel motor was produced in Augsburg, in 1897, and the first motor for driving a ship in Winterthur in 1903. It was only one year before the death of its inventor in 1913 that the Diesel motor was first used for an ocean-going vessel, for in 1912 the Hamburg-American line launched the *Monte Penedo*, a vessel of 6,500 gross tons, with a 1,000 h.p. motor on board. About the same time, at the end of 1911, 40 oil-driven ships were under construction in English yards. What first definitely turned the scale, however, was the experience gained by the Danish twin-screw motor vessel *Selandia*, built for the Danish-East Asiatic Co., which made its trial trip in 1912. This was a vessel of 3,200 net tons, with a cargo capacity of 7,400 tons and fitted with a 1,250-h.p. motor. With a full cargo of oil, which she carried in a double bottom, she attained a speed of 11 knots, and with a cargo of 900 tons a speed of 13.35 knots. As compared with a steamship of equal size, whose heavy machinery and coal bunkers she lacked, she showed a clear gain of no less than 1,000 tons of cargo space.

One-Quarter Oil-Driven

In 1921 the world's motor fleet consisted of 1,475 vessels of 1,244,418 gross tons. To these motor ships should be added the 12,800,000 tons of cargo space in vessels which today use oil fuel. Accordingly oil shipping today comprises over 14,000,000 tons or nearly one-quarter of the world's total tonnage which on June 30 last amounted to 61,974,653 gross tons.

The price of motor fuel is, it is true, considerably higher than that of coal but that is a secondary matter in view of the great advantage over coal fuel offered by oil fuel and oil motors. The removal of the heavy machinery and the coal makes possible a saving on an average of about 5 per cent of the available cargo space. The more complete using up of the thermal unit in the case of an oil motor compensates to a great extent for the increased cost of the fuel unit. Recent observations show that in the case of a 10,000-ton Swedish vessel, which formerly used coal but now uses oil, 70 tons of oil were equal in efficiency to 220 tons of coal, and, moreover, it was found possible on a ten days' trip to increase the cargo formerly carried by 1,400 tons.

A further notable experience is that made recently by the 13,000-ton oil steamer *Java*, of the Danish-East Asiatic company, which on the Copenhagen-Suez-Capetown-Copenhagen trip, only had to refill her oil tanks once, while her Diesel motors showed a saving of the weight of 80 per cent as compared with a ship employing steam pistons and of 25 per cent as compared with a vessel using steam turbines. According to the latest observations the total working cost of the three methods of ship propulsion shows the following proportion:

Coal fuel	4
Oil fuel	2.5
Motors	1

This gives a very clear picture of the superiority of oil over coal as fuel, and the still greater superiority of Diesel motors.

There is, in addition, a considerable saving in personnel, which is a result of the simplified and much cleaner working, and which is doubly important at the moment when wages are so high.

The following figures show how large is the reduction of the number of stokers in the case of an oil-driven ship, and how much lower is the cost of re-fueling:

	Steam-ship	Oil-driven vessel	Reduction to
Number of stokers	246	60	21.8%
Working hours occupied in re-fueling and paid for	9,600	80	0.83%

Moreover, it should also be recorded that among the millions of tons of shipping laid up in 1921, in all shipping countries apart from Germany, owing to the supply being far greater than the demand, there was not one single motor vessel. This latter type of vessel could alone be run at a profit when steamships had ceased to be remunerative. There can be little doubt that oil-driven shipping will predominate in the future.—*Nautical Gazette*, 3 June, 1922.

DESCRIPTION OF NEW 11,000-TON VESSEL WHICH CONSUMES ONLY TEN TONS OF FUEL OIL PER DAY.—Burmeister and Wain of Copenhagen have just completed the motorship *Teneriffa*, which is the largest Diesel engined vessel yet turned out in these yards. The ship is 425 feet long, 55 feet broad, and 38 feet, 6 inches deep, with a dead-weight capacity of 10,875 tons.

The machinery consists of two main engines of the Burmeister and Wain 6-cylinder 4-cycle short stroke type. This installation will develop a normal average speed at sea of 11¼ knots, the stipulated normal consumption of fuel oil per day being 10 tons. On her recent trial trips the engines developed an average indicated horsepower of 3,383 at 138 revolutions per minute, the average speed being 12.29 knots.

The machinery is placed midship and the loading and unloading take place by means of five large cargo hatches, served by 12 winches. The 5-ton after winch has warping ends arranged on an elongated shaft to serve also as a warping winch.

The main engines are short stroke, forced lubricated, cross head engines on the front end fitted with three stage air compressors supplying the necessary injection air for atomizing the fuel oil.

All auxiliary machinery in the engine room as well as the deck machinery is electrically driven, the necessary current being supplied by three 60 k.w. Diesel dynamos. The voltage of the current is 220 volts and for the lighting purpose it is transformed down to 110 volts by means of a motor generator.

Each of the generators is sufficient for supplying the necessary current under normal working conditions at sea, whereas two or three generators have to be started, when the consumption of current is large, as is the case when the ship is maneuvering with the maneuvering compressor running, or when loading or unloading, the winches using much current.

The heating is effected by means of steam produced in a small cross tube boiler of 100 square feet heating surface, this boiler also being able to deliver steam for fire extinguishing in holds.—*Nautical Gazette*, 21 May, 1922.

HOW THE AUSTRIAN FLEET ATTACKED ITALY: A WELL-PLANNED OPERATION AND ITS CONSEQUENCES.—A further interesting chapter of the Austro-Hungarian navy's war history appears in the May number of the *Marine Rundschau*, jointly contributed by two officers of the old "K und K Marine," MM. Mazetti and Igálssy von Igály. They give the first detailed account of the naval attack against the Italian coast on May 24, 1915, immediately following Italy's declaration of war. According to the authors, it was known on May 20 that war was inevitable, and the Austrian fleet was at once made ready for action, but the order to raise steam was not issued

till the twenty-second. "The tension was acute, and officers and crews joyfully anticipated the signal. Finally, at 2:30 P. M. on the twenty-third, came the flagship's order, 'Raise steam in two boilers,' which at 5 P. M. was altered to 'All ships raise steam in all boilers.' The crews were then mustered aft to hear the reading of the declaration of war. Like a storm of hate, passion, joy, and lust of battle broke forth the resounding cheers. Men embraced one another, threw their caps in the air, and looked gleefully at their officers. Thus we began." The final preparations for sailing were hastily completed. All details of the projected attack on Italy had been worked out days beforehand, and at 6:30 P. M. the first group, led by the *Saida*, weighed and left harbor amidst scenes of great enthusiasm. They were followed by the destroyers and torpedo-boats, and then came the *Hapsburg*—to which old battleship Admiral Haus had temporarily transferred his flag—and the rest of the battle fleet.

A course was shaped for Ancona, 20 torpedo-boats sweeping ahead for mines. As none were found, the boats took up their screening positions when the fleet was five miles out, and four were detailed to accompany the battleships *Zrinyi* and *Radetzky*, which had a special mission to perform. At 12:30 A. M. in bright moonlight, an Italian airship was sighted and driven off by the flagship's A. A. guns. Two Italian torpedo-boats were also seen and fired at. Between 1:30 and 2:30 the *Radetzky* and *Zrinyi*, with their screening torpedo-boats, left the main body and proceeded to their assigned positions. The scouting group, consisting of *Saida, Szigetvar, Balaton*, and *Triglav*, had previously left to form a patrol line between Pedaso and Porto Tajer, while the *Csikos* and *Velebit* had been sent on ahead to reconnoitre the breakwater at Ancona, and, if possible, to sink shipping in the harbor. "Gradually the outline of the Italian hills became visible. At 2:30 the two squadrons separated, the second proceeding towards Ancona at higher speed, and the first continuing astern at low speed. At 4 A. M. the ships of the second squadron opened with all heavy and medium guns on military objectives ashore, the fire being returned slowly and feebly by the land batteries. Our ships steamed past Ancona at a range of only 4,155 yards. Shortly after the bombardment began two of our aeroplanes appeared over Ancona and used their machine-guns against Fort Alfredo Savio, driving the gunners from their pieces. Thirty bombs were also dropped." Austrian torpedo-boats boldly entered the harbor and torpedoed a steamer. The first squadron had been ordered to open fire at 13,120 yards, but, in obedience to a signal from the flagship, it closed the range to 6,500. The *Tegetthoff* opened at 4:30 A. M., and soon after all ships were firing heavy salvos, the *Erzherzog Franz Ferdinand* being the last to join in.

Columns of smoke and flame marked where the shells exploded, and a dense cloud of smoke and dust hung over the town. The fort and a steamer that lay on the stocks nearby were totally destroyed. The bombardment continued for nine minutes, after which, as all targets had been heavily damaged, the fleet drew off, and at 5 A. M. retraced its course. "There was a slight but undeniable nervousness of submarine attack, but the Italian report that the appearance of the submarine *Foca* had interrupted the bombardment and forced the fleet to retreat was not true." On the other hand, it is admitted that "a certain lack of squadron discipline" manifested itself during the return cruise, but this is attributed to the fact that no major evolutions had taken place for the previous nine months. Surprise is expressed that the Italian submarines at Venice made no attempt to intercept the fleet off Pola, which they might have attacked with success while it was altering formation to enter the swept channel.

Meanwhile, the other units of the fleet had performed the various tasks allotted to them. The "*Novara* group," comprising *Novara, Scharfschütze*, and *T. B.'s-78, 79, 80*, and *81*, led by Captain Horthy, had orders to attack

Porto Corsini and the enemy destroyers and submarines which were believed to be lying there. The destroyer *Scharfschütze* did, in fact, penetrate well into the narrow channel leading to the port, and opened fire on the infantry barracks, apparently causing many casualties. But the Italian batteries were on the alert, and a hot fire was directed against the *Novara* and *T.B.-80*, the latter being severely hit, while the *Novara* herself was repeatedly struck and had fairly heavy casualties. The *Scharfschütze*, however, escaped from the channel without damage. The armored cruiser *Sankt Georg*, with *T.B.'s-1* and *2*, had been ordered to attack Rimini and shell the railway bridge, station, barracks, sulphur works, and water reservoir at a range of about 4,400 yards, but in this case the bombardment was not very effective, and little damage appears to have been done. The battleship *Zrinyi*, with two torpedo-boats, had the task of shelling the important railway bridge over the Misa river at Senigaglia, which was done at range of 3,300 yards, the bridge, together with a troop train, being destroyed. The *Radetzky* bombarded the ferro-concrete railway bridge, 410 feet in length that spans the river Potenza, but, although a heavy fire was opened at only 2,200 yards, the damage inflicted was not serious.

While all these operations were in progress, the *Saida, Szigetvar, Balaton*, and *Triglav* patrolled the line between Pedaso and Porto Tajer, thus guarding the fleet against a surprise attack by enemy forces coming from the southward. The screen was further completed by cruisers and destroyers from Sebenico (*Helgoland, Admiral Spaun, Czepel, Lika, Orjen, Tatra, Wildfang, Streiter, Ulan, Uskoke*), which throughout the night patrolled between the Dalmatian and Italian coasts. At dawn on May 24 certain of these vessels attacked the Italian seaboard at Barletta, Manfredonia, and Termoli. Soon after the *Helgoland* had opened fire on Barletta, the Italian destroyers *Aquilone* and *Turbine* were sighted coming out. The former, zigzagging at high speed, escaped in the direction of Bari, but the *Turbine* was headed off by four Austrian destroyers and finally brought to a standstill with a shell in her boilers, but not before she had damaged the *Czepel*. She was abandoned after the crew had been removed, and eventually foundered. While engaged in this rescue work the Austrians sighted two enemy vessels approaching, which were at first taken for battleships, but soon identified as the *Liba* and an auxiliary cruiser, their obvious purpose being to cut the *Helgoland* and her destroyers off from Sebenico. A running fight now ensued at high speed, the range varying from 8,750 to 9,800 yards, during which, it is claimed, the *Liba* received two hits. The Italian fire was "very good," the first salvo falling close alongside and the second straddling both *Helgoland* and *Czepel*, though neither was hit.

In summing up these initial operations against Italy the authors claim that complete success had been achieved. "While the enemy suffered heavy losses in men and material, we lost not a single vessel, and our casualties were light. The purpose of the attack, that of crippling enemy traffic on the east coast, and thus delaying the advance of the Italian army, had been completely fulfilled. The moral results were also considerable. Austria-Hungary's preparedness for war at sea had a very depressing effect on the inhabitants of the Italian east coast, and this effect lasted all through the war, paralysing the coastal shipping. Troops refused to proceed north by the coast railway; large concentration camps with strong garrisons were established along the seaboard; and the Italian war industry was called upon to provide a great deal of material for the defence of this vulnerable frontier. It is an established fact," the authors declare, "that the consequences of this naval operation strongly influenced the opening stages of the campaign on the Isonzo front; indeed, it may be affirmed that but for this operation Italian troops could have pressed far beyond the Isonzo almost without fighting, by sheer

weight of numbers, and perhaps even have reached our originally planned line of defence at Adelsberg. In any case, Italy was never so near to capturing, without appreciable loss, Trieste, and thus cutting off Istria and our fleet from the hinterland." It would be instructive to hear the Italian opinion on these claims.—*Naval and Military Record*, 24 May, 1922.

THE IMMUNITY OF PUBLIC SHIPS.—The immunity of public ships is to be one of the chief items on the agenda of the conference to be held in London, on October, of the Comité Maritime International. It is understood that this has been arranged at the instance of the chamber of shipping of the United Kingdom, but the matter seems to have originated with a formal note addressed by Mr. Justice Hill to the Comité Maritime International in which he invited them to consider the question of the immunities of sovereign states in respect of proceedings against maritime property (ships and cargoes) owned or used by them. In his note, Mr. Justice Hill points out that a British sovereign cannot, against his will, be made subject to the jurisdiction of his own courts, nor can his property be proceeded against; and this immunity, in compliance with international comity, is extended by the British courts to foreign sovereign states.

The result is that where ships belonging to sovereign states are involved in collision, or where such ships and state-owned cargoes have salvage services rendered to them, they cannot be arrested or be made the subject of legal proceedings in the ordinary way unless the sovereign state consents. Even as regards ships privately owned, but in the possession or service of a sovereign state, the courts will not allow them to be arrested, because in this way the sovereign state would be deprived of their use. Several examples are given in the note. The *Broadmayne* was a British ship in the service of the British sovereign during the war. The action was for salvage, but all proceedings with a view to the arrest or detention of the ship were stayed so long as the ship should remain under requisition in the service of the crown. The *Messicano* was an Italian ship in the service of the Italian Government. It was involved in a collision, and a similar order was made.

The cases instanced by Mr. Justice Hill arose during the war, and the service in which the privately owned ships were engaged was in the nature of war service; but, as he points out, there seems to be nothing in principle to prevent privately owned ships in the service of a sovereign state being immune from arrest in respect of matters arising out of ordinary trade service, although this cannot be treated as settled law. The grave objections to the immunity of such ships from legal proceedings and arrest, at least when they are engaged in times of peace and in trade, are referred to in the note. In one case it was said: "It is a great hardship upon the persons who have claims against such privately owned vessels that they should lose their most substantial remedy (arrest); and, in the interest of safe navigation, it is most unfortunate that there should be a number of vessels navigating the seas whose owners know that however negligently they may be navigated, no maritime lien can be enforced on the vessel while it is in state employment."

Mr. Justice Hill concludes by expressing the opinion that a remedy for the unsatisfactory position at present existing is to be sought on such lines as these: if sovereign states engage in trade and own trading ships of their own or use trading ships of private persons, they should submit to the ordinary jurisdiction of their own and foreign courts, and should permit those courts to exercise that jurisdiction by the ordinary methods of writ and arrest; and it is a matter for consideration whether this should not apply also to state-owned ships not engaged in trade, at least, to the extent of providing some means whereby an undertaking to pay should take the place of arrest and bail. It is satisfactory that these

important questions are to be considered by the Comité Maritime International, especially as a committee was recently appointed by the lord chancellor to consider the whole question of civil proceedings by, and against, the British Crown. At present, as has been repeatedly pointed out, in all legal proceedings against the Crown, the dice are seriously loaded against the subject.—*Engineer,* 12 May, 1922.

THE SPANISH NAVY.—Alone among maritime powers of the second rank, Spain is devoting marked attention to the development of her navy. The programme of new construction now in hand makes quite an impressive showing, though it does not include any vessel above the grade of light cruiser. The *Reina Victoria Eugenia,* of this type, which was laid down at Ferrol dockyard in March, 1915, and launched two years ago, began her trials at the end of last November, when she is said to have easily exceeded her contract speed of 25.5 knots. The inordinate length of time occupied in building this ship was due entirely to the war, it being impossible to obtain delivery of certain materials and fittings until after the armistice. However much Spanish dockyards may have deserved their former notoriety for leisurely construction—some cruisers took twelve years to complete—they have since become remarkably efficient, and, given the necessary material, can now turn out war vessels as expeditiously as any other yards on the continent. The design of the *Reina Victoria Eugenia,* which closely resembles that of our light cruisers of the *Birmingham* class, was prepared as long ago as 1914, and is therefore obsolescent according to the post-war standard. The ship is 462 feet long over all, 49¾ feet in breadth, and draws 16¾ feet at full load. Her displacement is 5,600 metric tons. She is fitted with Parsons straight-drive turbines and 12 Yarrow boilers (coal and oil), the machinery developing 22,500 s.h.p. The main armament of nine 6-inch, 50-cal. guns, manufactured by Vickers, is arranged exactly as in H. M. S. *Birmingham,* but the two 21-inch torpedo tubes are above water instead of submerged. A 3-inch belt of nickel steel, carried up to the upper deck amidships and tapering to 1½ inches at the extremities, is reinforced by a protective deck with a maximum thickness of 3 inches.

Two cruisers of much improved type have been authorized, one of which is reported to have been begun at Ferrol. Particulars as given in the Spanish papers are as follows: Length, 537½ feet; beam, 52½ feet; displacement, 7,850 tons; machinery, geared turbines and oil-fired boilers, developing 80,000 s.h.p. for a speed of 36 knots. It is probable, however, that the designed speed does not exceed 33 knots. The armament consists of eight 6-inch, 50-cal. guns, all disposed on the centerline, six of them being twin-mounted; four 3-inch or 4-inch anti-aircraft guns, and twelve above-water torpedo tubes on triple carriages. These two ships are unofficially reported to be named *Augusta Victoria* and *Almirante Cervera.*

Other vessels authorized or building for the Spanish navy are: (a) Three flotilla leaders, displacement variously given as 1,350 and 1,600 tons, 34 knots, four 4-inch guns and four tubes; (b) several torpedo boats, of 180 tons and 28 knots; (c) six submarines, 710 tons submerged displacement, surface speed 16 knots, endurance 4,200 sea miles, armed with one 3-inch gun and four tubes: and (d) three gunboats, 1,350 tons, 15 to 18 knots, mounting four 4-inch guns. All the above work is divided between the Ferrol and Cartagena yards. In addition an aircraft-carrier and several auxiliaries are in hand.—*Naval and Military Record.*

SPEED LIMIT IN GREAT CANALS.—The following table shows the length of five of the world's leading canals and the maximum speed at which vessels are allowed to traverse these waterways:

Canal	Length in Miles	Miles per Hour
Amsterdam	15.5	5.6
Kiel	61	6.2
Manchester	35	6
Panama	40.5	8
Suez	104	6.1

—*Nautical Gazette*, 5 June, 1922.

CURRENT NAVAL AND PROFESSIONAL PAPERS

"French Naval Ideas"—*Quarterly Review*, April, 1922.

"Details of French Coastal Motor Boats"—*Engineering*, 15 May, 1922.

"The German Submarine Building Program, 1914-1918"—*The Engineer*, 21 April, 1922.

"The Northern Blockade"—*Journal of the Royal Artillery*, May, 1922.

"The Naval War, 1914-1915"—*Quarterly Review*, April, 1922.

"Some Proposals Made for the Protection of Merchant Ships Against Submarines"—*The Shipbuilder*, Annual Number, 1922.

"The New Crane Ship for the Navy"—*Technical Engineering News*, June, 1922.

"The Problem of Moving Airships"—*Scientific American*, June, 1922.

"Nozzle Losses in Compound Turbines"—*Engineering*, 19 May, 1922.

"A Meter for Reading Alkalinity of Boiler Feed Water"—*Power*, 16 May, 1922.

"The North Atlantic Ice Patrol"—*Scientific American*, June, 1922.

"Uncle Sam and Radio"—*Scientific American*, June, 1922.

"Photography of Bullets in Flight"—*Journal of the Franklin Institute*, May, 1922.

NOTES ON INTERNATIONAL AFFAIRS

FROM MAY 5 TO JUNE 5

PREPARED BY

ALLAN WESTCOTT, Professor, U. S. Naval Academy

OUTCOME OF GENOA CONFERENCE

RUSSIAN PROBLEM UNSOLVED.—The break-down of the Genoa Conference for a general economic settlement in Europe was made certain when on May 11 the Russian delegates presented a long argumentative reply unfavorable to the terms offered by the other powers. In the hope of a foreign loan, Russia had been willing to accept most of the conditions laid down by the Allies, including recognition of war and pre-war debts, and had hesitated only over the restoration of property. Failing definite promises of a loan, Russia's attitude changed. The Russian reply declared that the purpose of the powers in haggling over private property was in reality to destroy the communistic system, that political questions, such as Russia's relations with Turkey and Rumania, had been needlessly injected into the discussion; and finally that governments arising out of revolution could rightfully repudiate the obligations of governments overthrown.

PLAN FOR DISCUSSION AT THE HAGUE.—Following the failure of Russian negotiations at Genoa, Premier Lloyd George proposed that these negotiations be resumed at The Hague. According to this plan the nations represented at Genoa, except Germany and Russia, were to send representatives from which a commission of experts would be selected to formulate a Russian policy. The experts would meet on June 16, and on June 20 present their conclusions, which would then be taken as a basis for negotiations with the Russian delegates. Upon the acceptance of this proposal by Russia the Genoa Conference ended on May 17.

The agreement contains six clauses, summarized as follows:

Clause I.—Provides for the appointment of a commission by the powers to examine again the divergencies existing between the Soviet Government and other Governments, and with a view to meeting a Russian commission having the same mandate.

Clause II.—Not later than June 20 the names of the powers represented on the non-Russian commission and the names of the members of this commission will be transmitted to the Soviet Government, and, reciprocally, the names of the members of the Russian commission will be communicated to the other Governments.

Clause III.—The questions to be treated by these commissions will comprise debts, private properties and credits.

Clause IV.—The members of the two commissions must be at The Hague on June 26.

Clause V.—The two commissions will strive to reach joint resolutions on the questions mentioned in Clause III.

Clause VI.—To permit the commissions to work peacefully, and also to re-establish mutual confidence, the Soviet Government and its allied republics on the one side and the other governments on the other, pledge themselves to abstain from any act of aggression and subversive propaganda. The pledge for abstaining from any act of aggression will be based upon the present *status quo*, and will remain in force for a period of four months after the conclusion of the work of the commission.

The pledge concerning propaganda will oblige the Governments not to interfere in any way in the internal affairs of other states, and not to assist, financially or by any other means, political organizations in other countries, and will oblige them to suppress in their territory "any attempt to commit acts of violence in other states or aiming to disturb the territorial or political *status quo*."

The final adoption of the truce compact was without incident except that Lithuania inquired whether the truce would prevent powers other than Russian from attacking each other. In other words Lithuania was anxious to know whether Poland would be prevented from attacking Lithuania in connection with the dispute over Vilna or the other boundary questions between the two nations. Assurance was given the Lithuanians that the peace would be general.

UNITED STATES REFUSES TO JOIN CONFERENCE.—When the conference at The Hague was proposed, it was hoped that the United States would send a delegation, and an invitation was at once extended. On May 15, however, Secretary Hughes declined the invitation in a reply the main part of which reads as follows:

The American people have given the most tangible evidence of their unselfish interest in the economic recuperation of Russia, and this Government would be most reluctant to abstain from any opportunity of helpfulness.

This Government, however, is unable to conclude that it can helpfully participate in the meeting at The Hague, as this would appear to be a continuance under a different nomenclature of the Genoa Conference and destined to encounter the same difficulties if the attitude disclosed in the Russian memorandum of May 11 remains unchanged.

The inescapable and ultimate question would appear to be the restoration of productivity in Russia, the essential conditions of which are still to be secured and must in the nature of things be provided within Russia herself.

While this Government has believed that these conditions are reasonably clear, it has always been ready to join with the Governments extending the present invitation in arranging for an inquiry by experts into the economic situation in Russia and the necessary remedies. Such an inquiry would approximately deal with the economic prerequisites of that restoration of production in Russia, without which there would appear to be lacking any sound basis for credits.

It should be added that this Government is most willing to give serious attention to any proposals issuing from the Genoa Conference or any later conference, but it regards the present suggestions in apparent response to the Russian memorandum of May 11, as lacking, in view of the

terms of that memorandum, in the definiteness which would make possible the concurrence of this Government in the proposed plan.

ATTITUDE OF FRANCE.—At the Genoa Conference the solidarity of France and Great Britain was seriously threatened by their divergent views on Russia. France, followed by Belgium, Poland, and the Little Entente, held that what the Soviets had taken from foreigners they must return, while the English were willing to accept posesssion, with technical ownership vested in the Soviet Government. When the Hague Conference was proposed, the French and Belgian delegates felt it necessary to leave the decision to their respective governments. On June 3, Premier Poincaré published a memorandum stating the French position. The memorandum declared that first of all Russia should be forced to withdraw her note of May 11, and then should accept flatly recognition of her war debt, prewar debt, and return of naturalized property formerly owned by foreigners. Russia must drop her counter-claims, and realize that she can get no government loan now. Then and then only should the experts take up the problem of help for Russia.

Speaking before the Chamber of Deputies on June 1, M. Poincaré declared that while he did not seek to break the Entente, France must be treated as an equal and not "dragged along at England's tail." As regards the Hague Conference, France, he said, had reserved entire freedom of action. Without the United States the inquiry would be necessarily incomplete, and the reconstruction of Europe without the great creditor republic would be chimerical.

ITALY AND THE NEAR EAST

RUSSO-ITALIAN TRADE AGREEMENT.—In accepting the proposal for a conference at The Hague, Italy as well as Japan and other states reserved the right to conclude trade agreements with Russia which were already under negotiation. Accordingly, on May 24, Italy and Russia signed a commercial treaty completing the provisional accord of last December. Russia was ready to grant even more extensive concessions with the idea of showing what the other powers had lost by their attitude at Genoa. Italy, however, was unwilling to enter into any agreement which would sacrifice her moral obligations to her allies.

JUGO-SLAV AGREEMENT WITH ITALY.—*Rome, May 8.*—While the delegates of Italy and Jugo-Slavia are striving to reach a political agreement, an important commercial and financial pact has been signed at Genoa, as a result of long negotiations, according to the newspaper *Italie*. The agreement creates a union between Jugo-Slav and Italian banks and is expected to facilitate a further interchange of goods, an interchange which already exceeds 1,000,000,000 lire yearly.

The agreement was signed by Italian deputies on behalf of a group of banks in Lombardy and Venetia, and besides safeguarding Italian imports within Jugo-Slavia, it is intended to aid in the demoblization of Italian credits, amounting to several hundred million lire, subject to a moratorium in Jugo-Slavia. Adriatic ports, especially Trieste, benefit greatly from the new pact, which marks a new era in Italo-Slav relations.

An agreement on the question of Fiume's difficulties is almost impossible and Jugo-Slavia is, therefore, insisting that the whole question be remitted to the arbitration of the president of Switzerland.—*Christian Science Monitor*, 9 May, 1922.

INVESTIGATION OF TURKISH ATROCITIES.—On May 15 Mr. Austin Chamberlain announced in the British House of Commons that Great Britain had proposed to France, Italy, and the United States a joint investigation of charges of Turkish cruelty to Greeks in Asia Minor. The charges were based chiefly on the reports of Major F. B. Yowell and Dr. M. L. Ward, American officials of Near Eastern Relief at Harpoot. According to their reports the Turkish system of deporting Greeks eastward through Harpoot was resulting in countless deaths from hardship, exposure, and cruelty.

In an interview at Constantinople on June 1, Izzet Pasha, the Turkish foreign minister, admitted that the Greek population in Asia Minor had suffered, but made counter-charges against the Greeks. He claimed that Greece would eventually be unable to support the cost of her army in Asia Minor. Admiral Bristol, American high commissioner, was quoted as saying that peace could be established in Asia Minor in only two ways—either by the western powers' maintaining a large force there, or by leaving the Turks to handle the situation with substantial guarantees for the protection of minorities.

AMERICA TO JOIN INQUIRY.—On June 3 Secretary Hughes in the following statement announced the decision of the American government to take part in the Turkish investigation:

"On May 15, 1922, a note was received from the British Ambassador referring to reports of the renewal of the deportation of Christians by the Turkish authorities at Angora and the alleged atrocities connected therewith, and communicating a proposal of the British Government that the American, British, French and Italian Governments should at once depute carefully selected officers to proceed to such places in Anatolia as might best enable them to conduct an appropriate investigation.

"In a subsequent memorandum of May 19 the British ambassador indicated that the Turkish deportations and outrages might lead to retaliatory action in territory held by the Greek forces, and suggested that the Government of the United States should join in requesting the authorities functioning in Greece to permit the dispatch of officers to regions under Greek occupation.

"In answering these communications, the secretary of state has said that the situation of the Christian minorities in Turkey has enlisted to a marked degree the sympathies of the American people and it has been noted with deep concern, that the work of benevolent and educational institutions in Turkey has steadily been hampered, that the rights which American citizens have long enjoyed in Turkey in common with the nationals of other powers have often been disregarded and the property rights and interests of Americans and other foreigners placed in jeopardy.

"In view of the humanitarian considerations which are involved and of the desire of this Government to have adequate information through a thorough and impartial investigation of the actual conditions prevailing in Anatolia in order that this Government may determine its future policy

in relation to the authorities concerned, the President is prepared to designate an officer or officers to take part in the proposed inquiry.

"In informing the British Government of the foregoing the Government of the United States has made it clear that the proposed action is limited in scope to an inquiry to obtain accurate data as to the situation in Anatolia for the information of the Governments participating therein, and has stated that this Government assumes no further obligation and enters into no commitment.

"In order to expedite the inquiry, it was at the same time suggested by this Government that officers should be designated by the respective Governments to institute inquiries concurrently in the districts respectively under Greek and Turkish occupation, and that these two commissions, upon the completion of their investigation, should unite in a comprehensive report."

MANDATES AND NAVAL TREATIES

RATIFICATION OF NAVAL TREATIES.—It was reported from London on May 29 that while the Washington naval treaties had not yet been ratified, measures to put them into force had already been taken, such as reduction of personnel and dismantling of battleships which are to be discarded. While the treaties might be brought before Parliament for a formal vote, this was not necessary since the signature of the King was sufficient for legal ratification.

The naval treaties were reported to the French Parliament on May 30 with a reservation attached similar to that adopted by the U. S. Senate. It was stated that consideration of the treaties would occupy at least a month, and that to the agreement prohibiting submarines from attacking merchant vessels a reservation might be made declaring that a merchant vessel to be so classified must be unarmed.

AMERICA ACCEPTS PALESTINE MANDATE.—*Washington, May 9.*—A vertual agreement has been reached between the United States and Great Britain with respect to the mandated territory of Palestine. The details of the agreement to be worked out will soon be incorporated into a treaty between the two Governments.

It is expected in general that the treaty will guarantee the rights of Americans to participate on an equal footing with the nationals of Great Britain or any other country in the exploitation of the natural resources of Palestine and in its commerce and industry. This is the fundamental doctrine of this Government with respect to mandated territories, it having been enunciated both by the Wilson and Harding administrations.

The tangible rights of Americans in Palestine consist chiefly of the so-called "capitulary rights," or rights of extra territoriality conferred upon the citizens of this country by the Treaty of 1830 with Turkey, and of certain rights acquired by the Standard Oil Company in Palestine prior to the World War.—*New York Times,* 10 May, 1922.

FRENCH MANDATES APPROVED.—On May 17 the United States Government announced its approval of the terms of the French mandates over Kamerun and Togoland in Africa, as well as the French mandate over Syria. Treaties with France will be negotiated similar to those with Japan over Yap and with Great Britain over Palestine. The mandate terms are

to be taken up at a special meeting of the League of Nations Council not later than July 15.

WORK OF LEAGUE COUNCIL.—The work of the League of Nations Council meeting at Geneva, which closed on May 17, was summarized as follows:

The work of the session, is declared to have been the most important since the founding of the council. Among other achievements noted are, first, the signature of the German-Polish economic treaty and the settlement of the Upper Silesian question; second, the throwing open of the Court of International Justice to the entire world, including Russia, Turkey and Mexico; third, the establishment of a financial and economic protectorate over Albania by the League of Nations; fourth, the setting of a definite date for the final disposition of the Palestine mandate, and fifth, the creation of a commission for international intellectual co-operation, with an American member.

The council also considered more than a dozen minor European questions and approved the Opium Commission's work.

It was decided by the council to hold its next meeting a week before the gathering of the General Assembly of the League of Nations, or about August 28. This date, however, is not intended to interfere with the extraordinary meeting of the council to be held probably on July 15, which will be devoted to mandates.

RATIFICATION OF SILESIAN TREATY.—It was reported from Genoa on May 9 that Foreign Minister Rathenau of Germany and Foreign Minister Skirmundt of Poland had accepted and signed the League of Nations Settlement of the Silesian problem. On May 30 the German Reichstag ratified the treaty, the flag on the Reichstag building appearing at half mast and the Chancellor and Cabinet in mourning.

It will be recalled that the Upper Silesian question was referred by the Supreme Council to the Council of the League of Nations after England and France were unable to agree on how the frontier between Germany and Poland should be drawn as a result of the unsatisfactory plebiscite. The council of the league drew a line and now it is accepted and instructions have been sent to the German and Polish representatives in Geneva to sign the treaty.

The document in addition to accepting the frontier is a large volume regulating the intricacies of the industrial region with in many instances raw materials and fuels in one country and factories in another, the workmen sometimes living in Poland and doing their day's work in Germany.

The treaty, modeled on the recommendation of the league agents, is to remain in force fifteen years.—*New York Times*, 10 May, 1922.

GERMAN REPARATIONS

ALLIED DEMANDS ACCEPTED.—The threatened reparations crisis of May 31 was avoided when on May 29 the German Government sent in an acceptable reply to the demands of the reparations commission. Germany submitted to Allied control of her finances to the extent of agreeing to turn in full and accurate budget figures to the reparations commission. Issues of paper money were to be stopped at least temporarily. Further laws were to be passed to prevent export of German capital from the

country and so far as possible to force its return. On May 24 the Reichsrat adopted the compulsory loan bill (which had already passed Reichstag) providing for the raising of about one billion gold marks. According to the German note, the success of all Germany's efforts to meet her obligations would be contingent upon the granting of an international loan.

The reparations commission unanimously accepted this reply on the part of Germany as "a sincere attempt to meet the commission's requirements," and on that basis agreed to a postponement of further German payments for the year 1922.

BANKERS CONSIDER GERMAN LOAN.—An international commission of bankers, including representatives of the Allied Powers, Holland, and the United States, met under the auspices of the reparations commission at Paris on May 24 to consider the possibilities of an international loan to Germany. One of the first acts of the committee was to state that no loan could be considered until Germany met the demands of the reparations commission, and this did much to hasten the favorable German reply of May 29.

On June 1 the British representative, Sir Robert Kindersley of the Bank of England, argued that a reduction of Germany's total reparations debt was an essential condition to her negotiating an internationl loan, on the ground that investors would not be attracted to such a loan, unless Germany were put in a position to "see daylight" financially.

This proposal at once revealed the political difficulties attending the loan problem, since France in particular would be reluctant to consent to a reduction of the reparations debt without a corresponding reduction of her own debt to the United States and Great Britain.

France regards all international indebtedness, including reparations, as one entity. Rightly or wrongly, she regards what Germany owes her for war damage—the figure was fixed by the International Commission of Five on which she had one vote—as just as much a debt as her debt is to the United States. She is willing to reduce Germany's debt to her if her creditors reduce their claims on her. In other words, France is willing to cut down the reparations total if Great Britain and the United States reduce her debt to them.

France probably is willing to do more than make a corresponding reduction. She may be willing to follow England's example and make a sacrifice in addition to the amounts cut off her debt. But with France burdened as she is by taxation to pay for the reconstruction of what Germany destroyed it is perfectly useless to talk to her about cutting down Germany's debt to her by tens of billions of dollars for the prospect of sharing in a billion dollar loan. French public opinion would not stand for that.

Therefore if such proposed international loan is to depend on reducing the reparation figure, and it is safe to say a majority of the bankers including those representing the countries from which the money would have to come considers that necessary, then America must say yes or no to Europe's question put by Britain as to whether she will sacrifice some of her claims for the general world good. It must be recognized that as seen

from this side of the Atlantic the prospects do not seem good until American public opinion sees the affair in a different light.

If it be true, as most authorities agree, that international debts are a monkey wrench in the machinery of international business, it is worth while to look at those debts. Europe owes America roughly $10,750,000,000, approximately as follows: England $4,573,000,000, France, $3,635,000,000; Italy, $1,800,000,000; Belgium, $410,000,000; Rumania, $38,000,000; Serbia, $55,000,000; Greece, $15,000,000, and Russia, $212,000,000.—*New York Times*, 16 May, 1922.

GREAT BRITAIN AND IRELAND

COALITION OF IRISH FACTIONS.—On May 20, after prolonged negotiations, an agreement was reached between the Collins and de Valera parties in Ireland by which a trial of strength in the coming elections was avoided and a coalition government established. The agreement provided that the control of the Sinn Fein organization (and later of the Irish Free State) be vested in a coalition cabinet, the army naming the minister of defense, and the other nine members to be taken, five from the majority and four from the minority party.

It provided further that nominations for the parliamentary elections be made on June 6, and elections held on June 16, and that the candidates be put forward as from the Sinn Fein organization and be taken from the two factions in such proportion as to give each faction the same strength as before. The purpose was thus to present an actual expression of popular opinion, although other interests and organizations were left free to nominate candidates and contest the election if they so desired.

CONFERENCE IN LONDON.—In order to explain the conditions arising from the new coalition in Ireland, and also to give information regarding the new Free State Constitution, Mr. Collins, Mr. Griffiths, and other Irish leaders came to London on May 26 for conferences with the British cabinet committee in Irish affairs headed by Winston Churchill. Apparently when the conferences closed early in June the British cabinet members were satisfied with the assurances given against violation of the Anglo-Irish Treaty.

Speaking in the House of Commons on May 31, Winston Churchill declared that the Collins-de Valera compact struck at the treaty, and that if de Valera refused to declare his loyalty to the treaty, Great Britain would feel at liberty if necessary to reoccupy Ireland. No deviation from the treaty, he declared, would be allowed either in strict letter or honest spirit.

In the meantime fighting and outrages continued in Belfast and along the Ulster border. On May 23 the Ulster Government issued a proclamation calling for the arrest of all members of the Irish Republican Army and similar organizations. On May 30 it was reported that Irish Republican forces had entered and established themselves within the six-county frontiers. Premier Craig of Ulster declared he would have no negotiations with the new coalition in the south. British reinforcements were being sent

to Ulster, and on June 5 attacked the southern Irish forces on the Ulster frontier.

BRITISH WAR FIGURES.—Speaking on May 26 at a luncheon, upon his return from Genoa, Premier Lloyd George gave some new and interesting figures as to the extent of Great Britain's participation in the war. He stated that Great Britain had mobilized, on land and sea, a total of 9,500,000 men; that between 5,000,000 and 6,000,000 of these went to France; that the British dominions sent 1,600,000 men and India 1,679,000; and that the total casualties amounted to 3,266,000.

FAR EAST

CHINESE GOVERNMENT REORGANIZED.—Following his victory over the Manchurian General Chang Tso-lin, General Wu Pei-fu announced his program for the unification of China and the establishment of a strong democratic government. As a first step in this program he declared his intention to force the resignation of both President Hsu Shih-chang at Peking and Sun Yat Sen at Canton. The Peking president vacated on June 2 and was to be succeeded by General Li Yuan-hung, who was president from June, 1916, to July, 1917, when he was overthrown by the militarists. The old republican Parliament met at Tientsin for the first time since 1917.

Washington, June 1.—It is believed by the officials here that recent developments have finally broken the apparently hopeless deadlock into which China had fallen as a result of the clashing ambitions of rival factions in the north and south. Not in the last ten years have the prospects been so bright for a reunion of the country as at this moment, it is said.

This belief is based upon confidence in the integrity of the victorious General Wu-Pei-fu, and his adherence to his plan for bringing the divided sections of the country together by insisting upon the retirement not only of President Hsu at the head of the Peking Government, but of Dr. Sun Yat Sen, who claims to be president as a heritage of the old parliamentary government and holds forth in that capacity in Canton.

General Wu also has promised to efface himself and surrender the command of his armies to any president who is legally chosen by the reconvened Parliament or a constituant assembly.

It is said that if the next step on the program of the reformers can be taken soon, and the numerous provisional armies can be discharged, leaving the sole military power in the hands of the central Government, any evil of militarism afflicting China will be overcome.—*New York Times*, 16 March, 1922.

JAPANESE LEAVE HANKOW.—On May 30 the Japanese minister at Peking notified the Chinese Government of the decision of Japan to withdraw her garrison at Hankow. Since 1911 Japan has maintained a garrison at this point to secure her interests in the Yangtse Valley. The withdrawal is in conformity with the resolution adopted in Washington to remove foreign troops from China as soon as the Chinese Government can afford protection. Ratifications of the Shantung Treaty were exchanged at Peking on June 2 and the treaty is now in full force.

REVIEW OF BOOKS

KIEL AND JUTLAND, by Commander Georg von Hase (Gunnery Officer of the *Derfflinger)*. Illustrated, 233 pages. Published by E. P. Dutton and Company, 681 Fifth Avenue, New York. Price $6.00.

Commander von Hase has presented seafaring men in general and naval men in particular with the most intensely interesting narrative of the battle of Jutland yet written. The chronological gunnery records kept aboard the *Derfflinger* during the battle form the basis of the description. The book is divided into two parts.

The first sets forth the visit of the British second battle squadron to Kiel during the last week in June, 1914. The author was then assigned to duty with the British commander, Vice-Admiral Sir George Warrender, and his observations are portrayed with a keen touch of human interest. A side-light of the visit is set forth in the following excerpt:

I realized the very day after the English ships arrived at Kiel that the English were extremely anxious to know all about the modern ships and craft of our fleet. Admiral Warrender sent me that day to our commander-in-chief, Admiral von Ingenohl, and I was commissioned to tell him that Admiral Warrender placed the English ships at the disposal of German naval officers who desired to see them. The admiral particularly insisted that the German officers would be shown *everything* which they cared to see for professional purposes.

Admiral von Ingenohl was absolutely averse to this proposal and instructed me to present his compliments to Admiral Warrender and say that he regretted that he could make no use of this kind invitation, as he could not return the compliment, because, in accordance with regulations, we were not allowed to show many parts of our ships to anyone.

The second part describes the battle of Skagerrak, as the Germans call the battle of Jutland. This recitation of his personal experiences during the battle is spell-binding. From his position in the conning tower he could see the enemy shells coming towards him. He says, "With each salvo fired by the enemy I was able to see distinctly four or five shells coming through the air. They looked like elongated black spots. Gradually they grew bigger, and then—crash! they were here. . . .And again, "Suddenly, we seemed to hear the crack of doom. A terrific roar, a tremendous explosion, and then darkness, in which we felt a colossal blow. The whole conning tower seemed to be hurled into the air as though by the hands of some portentous giant, and then to flutter trembling into its former position. . ."

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The book is well illustrated with photographs and charts. The description of the battle is divided into five phases as follows:

First Phase (5.48 to 6.55 P. M.)—*Queen Mary* engaged.
Destroyer attacks and their repulse.

Second Phase (6.55 to 7.50 P. M.)—The fifth battle squadron engaged.
Beatty's outflanking maneuver.

Third Phase (7.50 to 9.05 P. M.)—Heavy fighting against ships of the line, cruisers, and destroyers. Destruction of the *Invincible*. *Derfflinger* forced to stop to clear her torpedo-net.

Fourth Phase (9.05 to 9.37 P. M.)—The death ride of the battle cruisers.
The German fleet extricated. Destroyer attacks.

Fifth Phase (9.37 to 10.35 P. M.)—Last engagement. Night fighting.

In the final chapter the author in his reflections states why in his opinion, Admiral Jelicoe's strategy was sound.

We find these words in the closing pages of the book. "I close my account of the greatest day we Germans have ever experienced at sea, with the hope that my little book and Churchill's essay may be the means of enlightening many Germans on the enormous influence that sea power has had on the world's history and will continue to have in the future. . ."

I. C. K.